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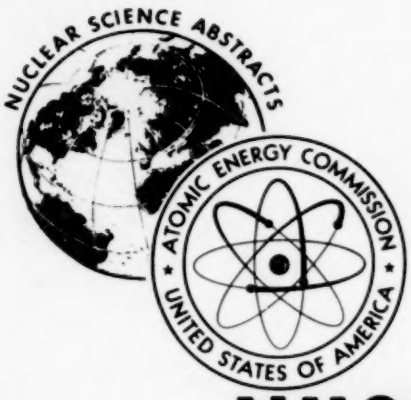

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Volume 17, Number 6, March 31, 1963

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NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

7655 (ANL-6600) ANNUAL REPORT 1961 [ON RESEARCH]. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 234p.

Research progress is reported on biological and medical sciences, physical sciences, mathematical research, reactor sciences, and accelerators. Topics covered include: radiation effects on biological systems, biochemical studies, electron-microscope study of the development of muscle fibers in grasshopper embryos, isotope substitution studies, nuclear structure, cosmochemistry, solid-state studies, radiation chemistry, physical and inorganic chemistry, instrumentation, Chebyshev quadrature on infinite intervals, a general theorem-proving program for the IBM-704, the approach to steady state of solutions of exterior boundary value problems for the wave equation, asymptotic properties of a boson field with given source, resultant procedure and the mechanization of the Graeffe process, the solution of reactor kinetics equations for large and small excursions, boiling-water reactors, the fast reactor program, reactor physics, nuclear engineering, and the 12.5-Bev proton accelerator. (M.C.G.)

7656 (BNL-6080) A COMPARISON OF THE NUCLEAR DEFENSE CAPABILITIES OF NUCLEAR AND COAL-FIRED POWER PLANTS. (Brookhaven National Lab., Tenn.; Sargent and Lundy, Chicago; and Burns and Roe, Inc., New York). May 1962. Includes Appendices A thru C. Also includes Appendix D. FUEL COST STUDY FOR VARIOUS REACTORS AT 100 AND 300 Mwe. E. H. Gift (Oak Ridge National Lab., Tenn.). Jan. 29, 1962. Contract [AT-30-2-GEN-17 and W-7405-eng-26]. 191p.

Appendices C and D may further be identified as SL-1925 and CF-61-12-20(Rev.), respectively.

A comparative report is presented in which the economics and feasibility of plant protection from nuclear attack by plant hardening, remote siting, and utilization of optional fueling concepts for the coal-fired plant are evaluated. (J.R.D.)

7657 (IDO-16817) MANUAL OF PROCEDURES FOR EFFECTING CONTROL OF SS MATERIALS AT STATION MTI. F. H. Tingey, B. S. Lewis, and A. E. Hall (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Nov. 1, 1962. Contract AT(10-1)-205. 99p.

The basic principles, philosophies, and techniques are presented which have been found necessary for the establishment and maintenance of an adequate control system for all nuclear materials used in the research and test reactors at Station MTI. The fundamental basis of the system is to assure the efficient control of nuclear materials by attempting to measure accurately and provide proper identification for the receipt, issue, use, and inventory of all such materials. The specific nuclear materials which are placed under the control system include source and fissionable materials and may also include other special material. (R.J.S.)

7658 (LAMS-2815) QUARTERLY STATUS REPORT ON LAMPRE PROGRAM FOR PERIOD ENDING NOVEMBER 20, 1962. (Los Alamos Scientific Lab., N. Mex.). Dec. 1963. Contract W-7405-eng-36. 16p.

The operation of LAMPRE I is summarized. The results of the examination of a defective fuel capsule and the Na coolant are given. The status of the core calculation program for the transport-theory description of core characteristics is described. The preparation of Pu–Co–Ce alloys is reported. The reactions of molten Co–Ce alloys with Ta are studied. Intergranular attack was observed in the exposure of TaC, NbC, and ZrC crucibles to U–Mn alloy at 1100°C. Data are given on the zeta phase, monocarbide, and sesquicarbide in the Pu–C phase diagrams, and on the other Pu systems: Pu–C–N, Pu–C–O, Pu–In, Pu–N, and Pu–rare earth. The status of the Core Test Facility (Phase A and B) is outlined. (D.L.C.)

7659 (MLM-1136) MOUND LABORATORY MONTHLY PROGRESS REPORT FOR APRIL 1962. J. F. Eichelberger (Mound Lab., Miamisburg, Ohio). Apr. 30, 1962. Contract AT(33-1)-Gen-53. 22p.

Research and development progress is reported on plastics, isotope separation and purification, the Ranger x-ray sensor, radioelements, and reactor fuels and materials development. (M.C.G.)

7660 (MLM-1137) MOUND LABORATORY MONTHLY PROGRESS REPORT FOR MAY 1962. G. R. Grove, L. V. Jones, and J. F. Eichelberger (Mound Lab., Miamisburg, Ohio). May 31, 1962. Contract AT(33-1)-Gen-53. 34p.

Research and development progress is reported on plastics, Ranger x-ray sensor, isotope separation and purification, radioelements, reactor fuels and materials development, and analytical methods. (M.C.G.)

7661 (MLM-1138) MOUND LABORATORY PROGRESS REPORT FOR JUNE 1962. G. R. Grove, L. V. Jones, and J. F. Eichelberger (Mound Lab., Miamisburg, Ohio). June 29, 1962. Contract AT(33-1)-Gen-53. 20p.

Research and development progress is reported on plastics, analytical methods, radioelements, isotope separation and purification, reactor fuels and materials development, Ranger x-ray sensor program, and SNAP IX. (M.C.G.)

7662 (MLM-1139) MOUND LABORATORY PROGRESS REPORT, JULY 1962. G. R. Grove, L. V. Jones, and J. F. Eichelberger (Mound Lab., Miamisburg, Ohio). July 31, 1962. Contract AT(33-1)-Gen-53. 27p.

Research and development progress is reported on plastics, Ranger x-ray sensor, radioelements, isotope separation and purification, and reactor fuels and materials development. (M.C.G.)

7663 (NP-12329) AUSTRALIAN ATOMIC ENERGY COMMISSION TENTH ANNUAL REPORT, 1961–1962. (Australia. Atomic Energy Commission). June 30, 1962. 90p.

Activities are reported on U prospecting and mining, reactor research, research other than reactor-associated, and radioisotope development. Information is also included on new buildings and equipment, world-wide nuclear power development, and general commission activities. (J.R.D.)

7664 COMMENT ON "CALCULATIONS ON A MANNED NUCLEAR PROPELLED SPACE VEHICLE." L. C. Moore (Aerojet-General Corp., Azusa, Calif.). ARS (Am. Rocket Soc.) J., 32: 1943(Dec. 1962).

Energy considerations in the change of a space vehicle from a hyperbolic orbit to a capture trajectory in a planetary gravitational field are discussed. Manned-vehicle Jupiter capture is described as an example. The duration of this mission is also discussed. (T.F.H.)

7665 CLAIM OF THE REACTOR INSURER AGAINST THE SUPPLIER OF NUCLEAR EQUIPMENT. Donald Etienne. At. Energy Law J., 3: 239-71(1961).

The Federal Law on the Peaceful Use of Atomic Energy and the Protection against Radiation, passed by the Swiss legislature in 1959 became effective on July 1, 1960. This legislation is the counterpart of the U. S. Atomic Energy Act of 1954. Among other matters it regulates the liability of the operator of a nuclear plant for injuries caused to third parties by a nuclear incident. The law is reviewed for the situation of the insurer and supplier within the rules of plural liability and the liability of the supplier. (C.H.)

7666 AVAILABILITIES AND NEEDS OF URANIUM IN COUNTRIES OF EURATOM AND THE WORLD. M. Barbato, M. L. Perilli, S. Pittori, and C. Tedesco (Comitato Nazionale Energia Nucleare, Rome). Comit. Naz. Energia Nucl., Notiziario, 8, No. 2, 3-12(Feb. 1962). (RT/EC(62)3) (In Italian)

A comparative estimate of availabilities and needs of uranium in the countries of E.E.C. and of the world, excluding socialist countries, is made. In the first part of the report, the reserves are evaluated and some previsions about uranium production are made. The second part deals with future needs of uranium. Finally, the foreseen production is compared with probable needs for peaceful uses in 1966, in addition to some technical and economic considerations. (auth)

7667 FIFTH GENERAL REPORT ON EURATOM. Comit. Naz. Energia Nucl., Notiziario, 8: No. 6, 5p. (June 1962). (RT/AI(62)3). (In Italian)

A report on Euratom activities from April 1961 to March 1962 was submitted to the European Parliament on April 14. The period covered practically marks the end of the First Five-Year Plan and the beginning of the Second Five-Year Plan (already submitted to the relevant authorities and still scheduled for early approval). Special consideration was devoted to the Orgel project. It involves full participation by the metallurgy, technology, reactor physics, thermal exchange, chemical physics, and chemistry departments. The report deals also with activities carried out under research contracts and in Common Center establishments; problems connected with nuclear energy development and radioisotopes; the First and Second Five-Year Plans; relations with third countries; and patents. (auth)

7668 GEOMAGNETIC DISTURBANCES ASSOCIATED WITH THE NUCLEAR EXPLOSION OF JULY 9. P. R. Pisharoty (Colaba Observatory, Bombay). Nature, 196: 822-4(Dec. 1, 1962).

The geomagnetic observatories at Annamalainagar (geographically 11°24′N; 79°41′E; geomagnetically 1.8°N; 149.4°E) and Trivandrum (geographically 8°29′N; 76°57′E; geomagnetically 0.9°S; 146.3°E) recorded marked changes in the Earth's field around 09 h U.T. on July 9, 1962. A megaton nuclear charge was exploded at this time at a height of 320 km over Johnston Island (geographically 16°42′N; 169°24′W; geomagnetically 14.3°N; 265.5°E). The changes at the two stations were similar in type and somewhat resembled a magnetic storm on a much smaller scale. Details of the changes are illustrated by magnetograms. The changes appeared to be a direct consequence of the injection into the exosphere of a large amount of protons and helium nuclei produced by the explosion. (C.H.)

7669 SUB-ACOUSTIC WAVES FROM RECENT NUCLEAR EXPLOSIONS. R. V. Jones and S. T. Forbes (Univ. of Aberdeen Scotland). Nature 196: 1170-1(Dec. 22, 1962).

Microbarographic data recorded at Aberdeen on July 9, 1962, of a wave-train appearing to have originated from the thermonuclear explosion near Johnston Island the same day are compared with data obtained on August 6 and 7, 1962, of a sub-acoustic wave-train from the Russian explosion near Novaya Zemlyia on August 5. Energy levels of the two explosions are discussed. (C.H.)

7670 RADIOGRAPHY OF THE GREAT BUDDHA AT KAMAKURA. Kenzo Toishi (Tokyo National Research-Inst. of Cultural Properties). Radioisotopes (Tokyo), 11: 337-43(Nov. 1962). (In Japanese)

In carrying out radiography on a bronze Buddha statue kept in a country temple, Co^{60} should be used as the irradiation source. However, the circumstances make the convenient irradiation apparatus unavailable in general, and the simple source had to be hung with a long string by remote operation. Preceding the recently performed repairing of the Great Buddha at Kamakura, a gamma radiographical study was carried out on the bronze wall of this Buddha. As the results of this study, mention is made on blow holes, thickness, cracks, and so on. Cracks seen in this statue can be said to be not very fatal, because they can be classified as those which have been invoked by the thermal stress in the original state when the statue was made. The study revealed the imperfectness of fusion between two consecutive parts of the statue cast by parts. On the inside surface of this statue, at junctions of consecutive parts, three kinds of reinforcing devices made in the course of casting can be seen. It is clear that the people in the Kamakura period were aware of the imperfect fusion of the junction of parts of the bronze statue cast part by part. (auth)

7671 PROSPECTS FOR NUCLEAR ENERGY. Felice Ippolito. Realtà mezzogiorno, 1: 103-20(1961). (In Italian)

The poor industrial and economical position of Southern Italy is indicated, with emphasis on the low per capita rate of electrical energy consumption in these regions, in comparison with that of the rest of Italy and the whole of Europe. As a consequence of this lack, a development program in these regions requires an electrical energy production much higher than the production required for

the rest of the country. Energy sources in these regions, however, are lacking. The elements, both technical-economical and social-economical, which justify nuclear power are examined. Also, the problem of competitiveness, along with consequences of Italian experiences (principally the ENSI project) and of swift progress in the nuclear field, offer favorable expectations. These expectations are strongly accentuated by the existing but inadequate organization of distribution. Newly coordinated modern electro-nuclear plants, therefore, acting as basic elements of a rational development program might, in a few years, bring the south of Italy to participate in the Italian energetic economy. (auth)

7672 PROLONGING USE OF RADIOACTIVE COBALT. P. Penchev (Oncological Scientific Research Inst., Sofia). Rentgenol. i Radiol., 1: No. 2, 17-23(1962).

In order to extend the useful life of Co^{60}, an applicator containing three instead of a single Co^{60} needle for intracavitary application was designed. In 120 measurements on dummies of 30 applicators of the triple-needle type containing isotope whose activity had fallen to around 35.1%, 28 of the applicators showed an activity varying only by +8.1 to −5.6% from predicted set values. Parker-Patterson grids were made from the applicators: 4 for a 6 cm^2 area, 8 for 24, or 14 for 36; dosimetry diagrams (log r/h vs cm distance from source) are given for all 3, along with diagrams of the original single-needle applicator and a new one. (P.C.H.)

7673 ULTRASONICS. OTS Selective Bibliography. Supplement to CTR-288. (Office of Technical Services, Washington, D. C.). Sept. 1962. 26p. (SB-500). $0.10 (OTS).

The bibliography lists ~240 reports on ultrasonics. The references are arranged according to the application: medicine and biology, nondestructive testing, cleaning, welding, metallurgy, etc. (D.L.C.)

7674 PROCEEDINGS OF THE NASA-UNIVERSITY CONFERENCE ON THE SCIENCE AND TECHNOLOGY OF SPACE EXPLORATION, CHICAGO, ILLINOIS, NOVEMBER 1-3, 1962. VOLUME 1. (National Aeronautics and Space Administration, Washington, D. C.). Dec. 1962. 436p. (NASA SP-11(Vol. 1)). $2.50(GPO).

Thirty-six papers are included; separate abstracts have been prepared for five. The remaining thirty-one papers cover such topics as NASA's role in space exploration; development of special skills for space research; the role of the universities in space programs; radar astronomy; sounding rockets; astronomical research in space; lunar and planetary sciences; celestial mechanics and space-flight analysis; data acquisition and processing; control, guidance, and navigation; and bioastronautics. (T.F.H.)

7675 SPACE FLIGHT STUDIES OF THE IONOSPHERE. Robert E. Bourdeau (NASA Goddard Space Flight Center, Greenbelt, Md.). p.115-27 of "Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration. Vol. 1." Washington, D. C., National Aeronautics and Space Administration, 1962.

Results from rocket and satellite experiments designated to study the characteristics of charged particles with thermal energies which comprise the ionosphere are discussed. Ground-based observations are compared with spaceflight data on the ionizing flux. This comparison is used to obtain modified models of the ionospheric D, E, and F regions. In addition, model concepts of the upper ionosphere up to 2000 km, including the helium ion layer and the lower protonosphere, are presented. (auth)

7676 PARTICLES AND FIELDS RESEARCH IN SPACE. George H. Ludwig (NASA Goddard Space Flight Center, Greenbelt, Md.). p.129-37 of "Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration. Vol. 1." Washington, D. C., National Aeronautics and Space Administration, 1962.

The energetic charged particle populations in space, and the characteristics of the magnetic fields that interact with them, are summarized. A discussion is given of the galactic cosmic rays, which are the largest-scale phenomenon, as well as solar cosmic rays, solar plasma, and the earth's geomagnetically trapped radiation (Van Allen radiation belts). (auth)

7677 ASTRONOMICAL RESEARCH IN SPACE. James E. Kupperian, Jr. (NASA Goddard Space Flight Center, Greenbelt, Md.). p.139-45 of "Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration. Vol. 1." Washington, D. C., National Aeronautics and Space Administration, 1962.

A description is given of the Aerobee rocket system, the Explorer XI satellite, the Orbiting Solar Observatory, the Orbiting Astronomical Observatory, and of the stellar-spectra results obtained by various of these systems. Intensity and spectral data are presented for the Orion nebulosity, α Virginis, α Carinae, and β and ϵ Canis Major. (T.F.H.)

7678 INTERPLANETARY SPACE PHYSICS. Conway Snyder, Hugh R. Anderson, Marcia Neugebauer, and Edward J. Smith (California Inst. of Tech., Pasadena). p.163-95 of "Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration. Vol. 1." Washington, D. C., National Aeronautics and Space Administration, 1962.

A review is presented of interplanetary fields (e.g., magnetic and gravitational fields); interplanetary matter, such as dust, meteors, meteorites, comets, and charged particles; solar disturbances and their terrestrial effects; and cosmic radiation. (T.F.H.)

7679 ANALYSIS OF SATELLITE ORBITS FOR GEOPHYSICAL EFFECTS. William M. Kaula (Goddard Space Flight Center, Greenbelt, Md.). p.241-51 of "Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration. Vol. 1." Washington, D. C., National Aeronautics and Space Administration, 1962.

Energy-dissipating surface forces on a close earth satellite give rise to a spectrum of orbital variations that is continuous and irregular, confined mainly to the mean anomaly, and predominant at the low frequency end (i.e., one cycle per several days). Conservation body forces on a close satellite give rise to a discrete spectrum of variations rich at the high frequency end (i.e., one or more cycles per day). Analysis of surface force effects yields upper-atmospheric models closely correlated in temperature variation with fluctuations in solar ultra-violet and corpuscular radiation. Further progress is dependent on solution of the problems of response of the atmosphere to solar flux and of the interaction of a satellite with its immediate environment. Analysis of gravitational effects on close satellite orbits gives determinations of north-south variations of the earth's gravitational field down to a 20° half-wave-length, and of east-west variations down to about a 50° half-wave-length. (auth)

7680 SURVEY OF SPACE POWER REQUIREMENTS—1962 TO 1976. William R. Corliss (Martin Co., Baltimore). ARS Preprint No. 2520-62. New York, American Rocket Society, 1962. Prepublication Copy. 15p. $1.00.

Probable space power requirements are assembled and reviewed for all expected military and nonmilitary space missions during the period in question. Data are presented that show average power requirements versus calendar years for eight mission classes. In addition to rough estimates of the number of power plants needed as a function of power level and calendar time, several technological trends are noted. There is a distinct grouping of requirements around the power plants under development. There is a strong trend toward standardized space vehicles that are capable of many functions. As a result, vehicle power levels are higher with increasing calendar time, though the actual number of plants needed in a given power range drops sharply as bigger power plants and more versatile space vehicles become operational. Booster development leads power plant development. (auth)

7681 PROPAGATION BY HIGH ALTITUDE CHEMICAL PLASMA RELEASES. N. W. Rosenberg and D. Golomb (Air Force Cambridge Research Labs., Bedford, Mass.). ARS Preprint 2587-62. New York, American Rocket Society, 1962. Prepublication Copy. 15p. $1.00.

A special application of ions in flames is discussed, the release of ionized combustion products (chemical plasma) into the upper atmosphere from vertical probe rockets. The objective of these experiments is to create a region of local high electron density for over-horizon communication and to study electron decay processes, mass transport, chemiluminescence and radiation from gases and solids ejected at high altitude. Deflagrative reactions of pure cesium nitrate-aluminum mixtures in a closed vessel are quenched upon vessel rupture with a low chemical yield and, consequently, a low overall ionization yield. Detonating mixtures of $CsNO_3$-Al-RDX give almost complete reaction during the initial stages of expansion. However, the electron yield is limited by the high pressure of the detonation zone. Improvement of the electron yield is expected from a low-pressure solid-propellant type burning of pure cesium nitrate and aluminum or alkali-seeded tetracyanoethylene and hexanitroethane. The resulting electron clouds are observed by reflected and scattered radar echoes. The radar cross-sections are dependent on altitude, time of day, and wind shear. The cloud most probably is a multiple scatterer in which the magnitude of the echo is proportional to the mean square fractional deviation of electron density within the scattering volume. Signals at frequencies below 50 mc have been propagated for ten minutes in night releases and tens of minutes in day releases. (auth)

7682 ATOM DLYA MIRA. PROGRESS V MIRNOM ISPOL'ZOVANII ATOMNOI ENERGII. (Atoms for Peace. The Progress in Peaceful Applications of Atoms). I. I. Alad'ev, ed. Moscow, Publishing House of the Academy of Sciences, 1962. 160p.

Seven articles are included on peaceful applications of nuclear energy and general data on thermonuclear fusion, reactor power plants, and naval vessels. Data are also given on applications of radioisotopes in industry and chemical research. The book is designed as a general survey for layman readers. (R.V.J.)

BIOLOGY AND MEDICINE

General and Miscellaneous

7683 (HW-SA-2853) PROBLEMS IN ECOLOGICAL SAMPLING. L. L. Eberhardt (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Dec. 12, 1962]. Contract AT(45-1)-1350. 15p.

Problems in ecological sampling are reviewed. Topics discussed include difficulties of definition in space and time, questions of procedure and analysis, problems involved in sampling mobile populations, problems in making actual measurements on individual plants or animals, variability in ecological studies, applications of estimates and comparisons in compiling data, and sampling efficiency in ecological studies. It is concluded that the abstraction provided by mathematical representation will help in identifying similarities, and the steadily increasing number of ecological studies will lead to improvement in sampling methods. (C.H.)

7684 (NYO-8103) PROGRESS REPORT [ON RESEARCH]. (Johns Hopkins Univ., Baltimore. Chesapeake Bay Inst.). Jan. 7, 1963. Contracts AT(30-1)-1477 and AT(30-1)-3109. 7p.

Results from mathematical and hydraulic models of the water movement and diffusion in the New York Harbor estuarine system were compared with a best estimate of probable distribution of an introduced contaminant at various locations and times after release. An improved mathematical model of New York Harbor was developed to simulate more closely conditions in the real system. Theoretical studies of the diffusion equations were continued, they were compared with observed diffusion data from estuarine, nearshore, and open sea locales. Field and laboratory chemical studies were made of the abundance and distribution of stable isotopes of the major trace metals in the estuarine environment. The problem of developing a suitable analysis for aluminum was studied. A synthetic culture medium, free from organic chelators, which will support growth of a variety of microörganisms was developed. Nutrient requirements of planktonic organisms for iron, manganese, zinc, and cobalt were studied. Preliminary investigation was made of the boron requirement of several microörganisms. (auth)

7685 (RT/BIO(62)5) THE GENETICS OF STREPTOMYCES COELICOLOR. D. A. Hopwood and G. Sermonti (Italy. Comitato Nazionale per l'Energie Nucleaire, Rome). July 1962. 105p.

The streptomyces are the bacteria with the most complex morphological differentiation. Genetic recombination is obtained in Streptomyces coelicolor A3(2) by mixing two genetically marked strains on complete medium and sowing the spores obtained from the mixed culture on suitable selective media. The frequencies of the various genotypes of recombinants obtained allow the estimation of linkage. A dozen markers have been located in two linkage groups. Certain recombinant colonies (heteroclones) are made up of a mixture of different genotypes; these originate from heterogenetic nuclei which divide for a number of divisions and then segregate, producing a great variety of haploid segregants. Study of segregation in the heteroclones allows a more complete genetic analysis, and also provides some information on the nature of the heterogenetic nuclei which give rise to the heteroclones. These nuclei have considerable deficiencies, which are attributed to the loss of terminal segments of chromosome. (auth)

7686 (TID-17424) DIFFERENTIAL EXTRACTION OF LYMPHOCYTIC AND RETICULUM CELL FRACTIONS FROM THYMUS. Ailene Herranen and Willa K. Brunkhorst (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). [nd]. Contract [AT(30-1)-2565]. 8p.

Two methods are described for the fractionation of thymus. Results using Method I indicate that sequential extraction with water or saline does not provide information distinguishing nuclear and cytoplasmic relationships. Data from Method II demonstrate that nuclei and cytoplasmic fractions of lymphocytes are obtained by slow stirring in sucrose-$CaCl_2$. The cytoplasmic fraction amounts to approximately 40 per cent of the mass of the cell. Only 20 per cent of the dry weight of the nuclei is non-nucleohistone material. Homogenization of residual tissue at top speed in a Waring blender results in only 15 per cent more material extracted. (auth)

7687 (UCLA-509) WHY "RADIOISOTOPES" IN THE DIAGNOSIS OF RENAL HYPERTENSION. George V. Taplin (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). Nov. 1962. Contract AT(04-1)-Gen-12. 56p.

Radioisotope techniques are gaining importance in the diagnosis and evaluation of kidney disorders. Three tracer procedures have been developed during the past seven years, namely the renocystogram, renal scanning procedures, and a quantitative method for measuring effective renal plasma flow. These radioisotope tests give useful information on total and individual kidney plasma flow, disclose blockage within the upper urinary passage, display kidney size, shape and distribution of tracer, and thereby provide the physician with important clues to the correct diagnosis. Also they supplement the information given by biochemical tests, aid the radiologist in interpretation of pyelograms and renal arteriograms, and in many instances may be used in place of more technically difficult surgical or radiological procedures. The value of employing radioisotope procedures in conjunction with radiography of the kidneys for the investigation of patients with suspected renal hypertension is stressed. Some fruitful areas of future study are mentioned. (auth)

7688 COMMUNICATION: FROM MOLECULES TO MARS. Melvin Calvin (Univ. of California, Berkeley). A.I.B.S. (Am. Inst. Biol. Sci.) Bull., 12: 29-44(Oct. 1962). (UCRL-10424)

A detailed discussion is presented of the probable process of chemical evolution and the generation of molecular communities which form part of terrestrial organisms. Two qualities (energy transformation and communication to other organisms) are taken as basic attributes of living systems, and a sequence of events which might have produced them from nonliving origins is described. The production of simple organic materials in primeval conditions with high-energy radiation sources is described. The evolution of catalytic systems from these materials is considered. The intrinisic ability of proteins and nucleic acids to arrange themselves in a highly ordered array is discussed. The development of the cellular structure is discussed briefly. Finally, the possibility of extraterrestrial life is considered. (D.L.C.)

7689 AN ISOTOPE-DILUTION METHOD FOR SIMULTANEOUS MEASUREMENT OF HEART MINUTE VOLUME AND CORONARY CIRCULATION. Max Frimmer, Gerhard Lange, and Klaus Resag (Universität, Tübingen, Ger.). Arch. Exptl. Pathol. Pharmakol., 241: 356-68(1961). (In German)

The technique is carried out by injection of Au^{198} into the left auricle and P^{32} into the aortic arch followed by continuous measurement of radioactivity in carotid blood. (H.H.D.)

7690 DIAGNOSIS OF FUNCTION OF THE HEART WITH Kr^{85}. A. Hardewig and R. Knebel (W. G. Kerckhoff-Instituts der Max-Planck-Gesellschaft, Bad Nauheim, Ger.). Atomkernenergie, 7: 457-63(Dec. 1962). (In German)

The application of Kr^{85}, both in its physically dissolved state by means of continuous infusion or by single injection, and in its gaseous state is discussed. Continuous infusion as a means of determining the cardiac output is described at length. The principles of this method are presented in detail. The application of the method in various clinical problems and the results of investigations are described. The importance of the method in studying the function of the heart is also pointed out in this connection. The ease with which Kr^{85} may be handled in single injection for the determination of the cardiac output, and its advantages over other indicators are shown. The single injection is suitable for the detection of right-to-left shunts, and in certain cases of left-to-right shunts as well. In its gaseous state Kr^{85} has proved particularly valuable in the detection of left-to-right shunts. (auth)

7691 IN VIVO BIOGENESIS OF THYROID HORMONE IN THE GUINEA PIG. William J. Schindler and Claude Fortier (Methodist Hospital, Houston, Texas and Baylor Univ., Houston, Texas). Can. J. Biochem. Physiol., 40: 1641-6(Nov. 1962).

The uptake and organic binding of I^{131} by the guinea pig thyroid were studied as ordinates of time following administration of the tracer by means of electrophoretic, radioautographic, and chromatographic techniques. Similar techniques were used to ascertain the nature of the iodinated compounds in the gland at the time of maximal uptake. Results indicate that the iodine content of the diet is an important factor in experiments of the type described. Preliminary data are reported on the biogenesis of thyroid hormone. (C.H.)

7692 GENETIC STUDIES OF ad-8 MUTANTS IN NEUROSPORA CRASSA. I. GENETIC FINE STRUCTURE OF THE ad-8 LOCUS. Tatsuo Ishikawa (Yale Univ., New Haven). Genetics, 47: 1147-61(Sept. 1962).

A new group of adenine-requiring mutants in Neurospora crassa — at the ad-8 locus — has been located 26 map units to the left of the centromere in linkage group VI. A total of 308 primary ad-8 mutants (obtained from wild-type 74A or other closely related wild-type strains) and 77 secondary ad-8 mutants (obtained from revertant strains at this locus) have been isolated. These mutants are blocked in the conversion of inosine monophosphate to adenosine monophosphate succinate (AMP-S) and lack AMP-S synthetase activity. Interallelic crosses using 175 primary and secondary mutants have shown that this locus is composed of at least 37 mutational sites arranged in a linear sequence — the intersite distances being generally additive. Three sites appear to be especially mutable without exhibiting mutagen specificity while at one other site occurred at least 15 independent mutations derived from experiments with 5-bromodeoxyuridine and 5-fluorodeoxyuridine. Fourteen out of 70 mutants tested failed to yield reverse mutants even after ultraviolet irradiation. Ten of these 14 mutants were multisite mutants which produced no prototrophs in intercrosses with two or more other ad-8 mutants located at different sites. Genetic analyses of induced secondary ad-8 mutants indicate that some apparent reverse mutants do not constitute a genuine return to the wild-type condition but tend to retain residual effects of the primary mutational extent. (auth)

7693 THE USE OF IODINE-125 AS AN X-RAY SOURCE IN ROENTGEN DIAGNOSTICS. P. Beronius (Royal Inst. of Tech., Stockholm), S. Forberg, C.-O. Henrikson, and R. Soeremark. Intern. J. Appl. Radiation and Isotopes, 13: 253-4(May 1962). (In English)

The use of I^{125}, which decays by electron capture with a half life of 60 days, for multimillicurie sources of x rays is described. A source is described that is composed of 12 mC of I^{125} activity, plated anodically on the hemispherical end (radius = 0.25 mm) of a silver wire. Roentgenograms obtained with this source are shown. (T.F.H.)

7694 STUDIES ON X AGENT. VIII. FIXATION OF TURBIDITY CHANGE IN PROTEIN SOLUTIONS INDUCED BY X AGENT. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Japan. J. Exptl. Med., 31: 83-98(Apr. 1961).

The properties of an atmospheric agent of unknown nature (X agent) were investigated. The agent appears to act in a north-south direction, can penetrate a Cu plate, and alters various biologic materials, including plant seeds, bacteria, blood cells, and protein. As tested on its ability to denature protein molecules in solution, a large temporal variation in the intensity of the factor was observed since on some days its action was weak or undetectable. (H.H.D.)

7695 STUDIES ON X AGENT. IX. EFFECT OF A LEAD SHIELD UPON X AGENT, WITH SPECIAL REFERENCE TO ITS ACTION ON THE GROWTH OF BACTERIA AND ON THE TURBIDITY OF PROTEIN SOLUTIONS. Hideo Moriyama and Hiroshi Ueno (Shonan Hygiene Inst., Kamakura, Japan). Japan J. Exptl. Med., 31: 99-110(Apr. 1961).

As measured by its ability to destroy bacterial cells (Proteus vulgaris) in broth cultures, an unknown atmospheric agent (X agent) can penetrate a 10-cm Pb shield. Similar results were found in tests of the ability of the agent to denature protein in aqueous solution. The effect of the agent in both systems was attenuated by 30- to 40-cm Pb shielding. It is suggested that X agent represents cosmic-like radiation of extremely high energy. (H.H.D.)

7696 STUDIES ON X AGENT. X. EFFECT OF LEAD SHIELD ON X AGENT, WITH SPECIAL REFERENCE TO ITS ACTION UPON RED CELLS. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Japan. J. Exptl. Med., 31: 111-18(Apr. 1961).

The action of an atmospheric agent of unknown nature (X agent) was assayed by measuring the amount of hemoglobin liberated from red cells, previously exposed to X agent, in the presence of hypotonic salt solution. A 10-cm Pb shield somewhat attenuated the action of X agent on red cells. A diurnal variation in the intensity of X agent was detected. (H.H.D.)

7697 PREPARATION OF P^{32}-LABELED COXIELLA BURNETII CELLS. Bill H. Hoyer and Edgar Pickens (National Inst. of Allergy and Infectious Diseases, Hamilton, Mont.). J. Bacteriol., 84: 873(Oct. 1962).

Coxiella burnetii cells labeled with P^{32} were prepared from chicken embryos infected with these rickettsiae in the

presence of P^{32}-orthophosphate. Procedures are described. (C.H.)

7698 CELLULAR VARIATION DURING THE IMMUNE RESPONSE: ONE POSSIBLE MODEL OF CELLULAR DIFFERENTIATION. T. Makinodan and Joseph F. Albright (Oak Ridge National Lab., Tenn.). J. Cellular Comp. Physiol., 60: Suppl. 1, 129-44(Oct. 1962).

Results are summarized from a series of studies of cellular differentiation during the immune response. In vivo culture methods are described that were used to determine the cellular kinetics of radioinduced inactivation of the immune response. The significance of the quantitative cytokinetic data are discussed. It is concluded that, following an antigenic stimulation, potentially competent cells undergo differentiation and somatic division leads to the appearance of non-dividing, antibody-containing plasma cells. (C.H.)

7699 SOME ASPECTS OF MUTATION. Bernard S. Strauss (Univ. of Chicago). J. Theor. Biol., 2: 266-78(May 1962).

The existence of an independent metabolism makes the response of free-living organisms to mutagens more varied than the response of viruses. Materials which inactivate virus can be mutagenic for free-living organisms. Metabolic systems permit organisms to bypass the phenotypic effect of some mutations and may themselves create conditions favoring mutation. The evidence indicates that mutation can take place in the absence of DNA synthesis. A process of base exchange in DNA must account for this class of mutations. However, the lack of segregation following treatment with certain mutagens is not a sufficient argument for mutation in the absence of DNA synthesis and an attempt to develop alternate explanations for the lack of segregation is made. A hypothesis is developed to account for the importance of protein synthesis in the mutation process. The hypothesis assumes that conditions favoring protein synthesis cause the DNA to become available for replication and that this available stage is a necessary intermediate in DNA synthesis. The period leading to the production of this intermediate is critical for the mutation process as induced by ultraviolet light and by alkylating agents. (auth)

7700 INITIATION OF IMMUNE RESPONSES BY SMALL LYMPHOCYTES. J. L. Gowans (Sir William Dunn School of Pathology, Oxford), D. D. McGregor, Diana M. Cowen, and C. E. Ford. Nature, 196: 651-5(Nov. 17, 1962).

The large pyroninophilic cells that arise from small lymphocytes in graft-versus host reactions were observed to resemble morphologically the cells that appear in regional lymphoid tissue during the reaction against homografts of skin and during antibody formation. This resemblance, together with the demonstration that the small lymphocyte is immunologically competent, suggest that primary immune responses in general may be initiated by the interaction of antigens with small lymphocytes. This possibility was investigated in two groups of experiments. The identity of the cell-type formed by the dividing large pyroninophilic cells was determined by studying the fate of rat small lymphocytes in the spleen of lethally irradiated mice. The significance of these experiments for the homograft reaction was then examined. Rats were rendered immunologically unresponsive to skin homografts, sheep erythrocytes, and tetanus toxoid. Suspensions of small lymphocytes from other rats were then injected intravenously to test their ability to abolish the unresponsive states. In each experiment the proportion of small lymphocytes in the inoculum was estimated in smears from a count on 2,000 cells. The proportion ranged from 99.4 to more than 99.95%. Results indicate that small lymphocytes are involved in the inductive phase of antibody formation. It is postulated that small lymphocytes interact with antigen, become fixed in lymphoid tissue, and give rise to a dividing cell line that generates the cells that eventually synthesize antibody. It is emphasized that this has not yet been unequivocally demonstrated. (C.H.)

7701 DISAPPEARANCE OF TRITIATED THYMIDINE AND TRITIATED WATER FROM THE ANTERIOR CHAMBER OF THE RABBIT EYE. Ronald M. Maenza and Clifford V. Harding (Columbia Univ., New York). Nature, 196: 786-7(Nov. 24, 1962).

The rate of disappearance of injected tritium-labeled thymidine from the anterior chamber of the rabbit eye was measured. Parallel experiments were performed to determine the rate of disappearance of tritiated water under similar conditions. Young American Dutch rabbits were used in all experiments. After phenobarbital anesthesia 0.1 ml of aqueous humor was withdrawn from the anterior chamber and replaced with 0.1 ml of tritiated thymidine at a concentration of 1 μc/ml in Eagle's basal medium with a specific activity of 1.90 c/mm or tritiated water at 40 μc/ml. Samples were withdrawn at intervals of 2.5 to 120 min and counted in a scintillation spectrometer. Results show a rapid disappearance of tritiated thymidine and of tritiated water from the anterior chamber. It is concluded that the availability of tritiated thymidine in the aqueous humor, following injection into the anterior chamber, is of short duration. The use of tritiated thymidine as a tracer in studies on the synthesis of desoxyribonucleic acid in the eye is discussed. (C.H.)

7702 DIFFERENTIAL DESTRUCTION OF THE TRANSFORMING ACTIVITY OF DAMAGED DEOXYRIBONUCLEIC ACID BY A BACTERIAL ENZYME. Bernard S. Strauss (Univ. of Chicago). Proc. Natl. Acad. Sci. U. S., 48: 1670-5(Sept., 1962).

Alkylation and ultraviolet irradiation were both shown to sensitize desoxyribonucleic acid (DNA) to further degradation without destroying the biological activity of the DNA. Results are reported from studies on alkylated transforming DNA prepared from wild-type B. subtilis differentially inactivated when incubated with an extract from M. lysodeikticus. No such differential sensitivity was observed when control and alkylated DNA were incubated with pancreatic desoxyribonuclease or with a cobra venom preparation. DNA alkylated with methyl methanesulfonate lost its biological activity on heating for 5 hr at 50°C. Irradiation with ultraviolet light sensitized transforming DNA to inactivation by extracts of M. lysodeikticus, and this sensitization appeared to be dose-dependent. In contrast to alkylated DNA, the ultraviolet-irradiated DNA was not sensitive to heat treatment. Possible reaction mechanisms responsible for the inactivation of alkylated DNA are discussed. (C.H.)

7703 RADIOISOTOPE MARKING METHODS OF FISH AND THE PUBLIC HEALTH CONSIDERATION. Yoshio Hiyama (Tokyo Univ.). Radioisotopes (Tokyo), 11: 389-93 (Nov. 1962). (In Japanese)

Marking or tagging experiments have become important in recent years to study the migration of fish, effect of artificial liberation, and the population of fish in a certain water area. The two types of marking of fish by radioisotopes which were employed since 1954 are described. One is an abdominal insertion of a coated Co^{60} pin, 0.1 to 1 mc to each individual of fish. The other is a radioisotope contamination of fish by either oral ingestion or muscular injection or uptake through gill. The radioisotope used was Zn^{65}, 0.1 μc

per individual of fish in average The effective half life of Zn^{65} in fish is found to be 12 days. Drinking water contamination from the fish which had been liberated, and unexpected catch of radioactive fish by people are considered from standpoint of radiation public health. (auth)

7704 THE DEPARTMENT OF NUCLEAR MEDICINE OF THE VITTORIO EMANUELE III INSTITUT FOR THE STUDY AND TREATMENT OF TUMORS. A. Ratti and G. L. Buraggi (Università, Milan). Radiol. Med., 48: 1041-57(Nov. 1962). (In Italian)

Basic criteria that must be followed when constructing a department of nuclear medicine, together with the problems of protection to be considered when drawing up such a project are discussed. Details of the construction characteristics of the Department of Nuclear Medicine of the Milan Cancer Institut, with special reference to the solution of problems regarding protection against radiations, prevention of contamination, and disposal of radioactive wastes are given. (auth)

7705 WHAT CAN WE EXPECT TO HAPPEN? C. C. Lushbaugh (Los Alamos Scientific Lab., N. Mex.). Rocky Mt. Med. J., 59: 37-40(Jan. 1962).

Radiobiological aspects of nuclear weapons detonations are discussed. (H.H.D.)

7706 STRAHLENBIOLOGIE. GRUNDLAGEN UND ERGEBNISSE. (Radiation Biology. Principles and Results). H. Fritz-Niggli. Stuttgart, Georg Thieme Verlag, 1959. 379p. D.M. 65.

7707 RADIOACTIVE ISOTOPES IN MEDICINE AND BIOLOGY. Basic Physics and Instrumentation. Second Edition. Edith H. Quimby and Sergei Feitelberg. Philadelphia, Lea and Febiger, 1963. 343p.

Part I. Basic concepts of radiation, radioactivity, nuclear reactions, and nuclear fission are reviewed. Methods used in the calculation of radiation dosage are described. The biological effects of radiation and radiation hazards are discussed, and national and international recommendations for maximum permissible doses are reviewed. Pertinent safety procedures are outlined. Part II. Radiation detectors are described and principles of operation are discussed. Auxiliary instruments and their uses are also discussed. Basic measurements and quantitative measurements, both in vitro and in vivo, are described. A separate section is devoted to radioautographic techniques. Applications of tracers in studies of physiological processes and methods for the determination of isotope distribution in the body are reviewed. The use of radiation detectors in health protection is discussed. The design of a radioisotope laboratory for clinical tracer studies is considered briefly. Useful constants and conversion factors are appended. (C.H.)

7708 THE USE OF CALCIUM-47 AND STRONTIUM-85 IN DIAGNOSTIC STUDIES. Karin Runbaeck Corey. Thesis, New York, Columbia Univ., 1962. 95p.

Radioisotope techniques were used to study calcium metabolism in healthy and diseased bones. It was decided to use gamma emitting tracers for calcium which would allow in vivo measurements on patients. The best possible radioisotope appeared to be Ca^{47} although some studies were carried out with Sr^{85}. Since Ca^{47} was a new radioisotope and was to be used in the human, the technical aspects of preparation, and assay had to be developed. The dosimetry was considered and a guide was established for tracer doses of Ca^{47} and Sr^{85}. To take full advantage of the isotopes new scanning techniques were developed using a specially constructed scanner. Information about the calcium uptake in normal bones and in various bone lesions were obtained in 46 studies on 33 patients. Many of the studies were complete metabolic studies, including calcium balance and accretion rate determinations. For practical purposes the most important finding was that elevated calcium uptakes occurred in the sites of osseous metastases, whether these were lytic or blastic. With the new scanning technique it was also demonstrated that elevated uptakes could be detected over lesions that were not yet visible on roentgenograms. The applications of the results to the early detection of bone metastases and to other clinical problems are discussed. (Dissertation Abstr., 23: No. 5, Nov. 1962.)

7709 DIAGNOSTICA E TERAPIA CON I RADIOISOTOPI. (Diagnostics and Therapy with Radioisotopes). P. Bastai, I. Antogenetti, G. C. Dogliotti, and G. Monasterio. Turin, Edizioni Minerva Medica, 1962. 949p.

A review of the principal studies done on diagnosis and therapy with radioisotopes is presented. The book is divided into four sections. The first section deals with the theoretical and practical fundamentals for an understanding of the use of radiosiotopes in diagnosis and treatment. The basic ideas of radioisotopic measurement are reviewed in the second section. The third section presents the applications of radioisotopes to clinical diagnosis, and the fourth section their application to clinical therapy. Abstracts have been prepared of the 35 papers compiled. (J.S.R.)

7710 ELEMENTS OF NUCLEAR PHYSICS. C. Tribuno. p.5-40 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

A brief survey is made of the elements of nuclear physics basic to the understanding of medical uses of radiation. The topics discussed are the atom, radioactivity, nuclear reactions, interaction of radiation with matter, and accelerators. (J.S.R.)

7711 MEASUREMENT OF RADIOACTIVITY. INSTRUMENTATION. G. Cesoni and G. Pelli. p.41-65 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The methods and devices used for the detection and measurement of radiation are described. Radiation detectors discussed are ionization detectors, scintillation detectors, nuclear emulsions, and detectors with special shapes and dimensions. The measurement apparatus described are electrical and electronic components, dosimetry and monitoring devices, pulse dividers or adders, and linear preamplifiers and amplifiers. (J.S.R.)

7712 PRINCIPLES AND METHODS FOR THE DOSIMETRY OF IONIZING RADIATIONS. C. Polvani. p.67-122 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

As an introduction to a consideration of the principles and methods of radiation dosimetry, some characteristics of radiation and the concept of absorbed dose are described. The physical and biological parameters affecting dose evaluation are analyzed. The methods used for the evaluation of the dose absorbed from external and internal sources are described. 90 references. (J.S.R.)

7713 PREPARATION OF RADIOISOTOPES. U. Rosa and G. A. Scassellati. p.123-45 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

A brief résumé is given of the techniques used in the production of the principal isotopes used in medicine. Isotopes cited are I^{132} (in the form of serroalbumen iodate), F^{18}, Fe^{59}, As^{76}, Cu^{64}, S^{35}, Na^{24}, K^{42}, P^{32}, Cr^{51}, and Au^{198}.

The physical, chemical, and biological purity control methods are discussed. (J.S.R.)

7714 SUPPLY AND MANIPULATION OF RADIOISOTOPES. U. Rosa. p.147-67 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The production of radiosiotopes for medical uses is developed in two phases—separation of the radiosiotope from the irradiated matrix, and distribution of the total activity produced into activity aliquots corresponding to the needs of the user. This second phase, including the activity distribution and packing, is considered. The manipulation of radioisotopes and protection from beta and gamma emitters are discussed. Protection materials, manipulation apparatus, and sampling of radioactive liquids are also reviewed. (J.S.R.)

7715 PRINCIPLES OF RADIOBIOLOGY. A. Vallebona, G. Farris, and L. Oliva. p.169-83 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The interaction between radiation and matter is first discussed with a consideration of the specific ionization. The effects of radiation on aqueous solutions, complex molecules, and enzymes are described. The direct and indirect effect of radiation and the effect of radiation on cells are indicated. (J.S.R.)

7716 CLINICAL RADIOBIOLOGY. A. Vallebona and N. Macarini. p.185-205 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The basic aspects of clinical radiobiology are first considered. The effects of radiation on normal tissues and organs—skin, digestive organs, glandular system, respiratory system, urinary system, masculine and feminine genital organs, blood and hematopoietic organs, mesenchymal tissues, cardiovascular system, nervous tissues, and sense organs—are then described. The effects of radiation on the organ in general are indicated. (J.S.R.)

7717 LESIONS AND DAMAGE FROM RADIATION. F. Fossati and L. Papagni. p.207-32 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The general concepts and definitions in radiation injury are indicated. A consideration of local non-neoplastic and neoplastic lesions is then given. General lesions such as hematological disorders, shortening of the life span, and acute radiation syndrome are described. Modifications of the development of the embryo, fetus, and the organism in growth are discussed. In conclusion, genetic effects are indicated. (J.S.R.)

7718 PROTECTION AGAINST THE IONIZING RADIATIONS PRODUCED BY RADIOISOTOPES. F. Fossati and G. Pompili. p.233-89 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

In a consideration of protection against radioisotopes, the concept of the maximum permissible dose is first discussed. External and internal irradiation and radioactive contamination are then reviewed. Factors to be considered in locating and equipping a laboratory for the medical and biological use of radioisotopes are indicated. Physical and pharmacological protective precautions against radiation are summarized. Monitoring, health physics, and decontamination measurements in work with radioisotopes are discussed. Measurement of the shielding in teletherapy is also considered, with a description of the protection needed for I^{131}, P^{32}, Au^{198}, C^{14}, and Co^{60}. (J.S.R.)

7719 ACTS OF THE ITALIAN LEGISLATURE ON THE SUBJECT OF RADIOISOTOPES IN THE REALM OF LAWS FOR PROTECTION AGAINST IONIZING RADIATION. G. M. Polvani. p.291-333 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The scope and purpose of the Italian laws on protection against radiation are indicated and illustrated. These laws are compared with the Euratom health directives on the same subject. (J.S.R.)

7720 METHODOLOGICAL PRINCIPLES. L. Donato and C. Giuntini. p.335-62 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The methodological principles in radioactive tracing of the dynamic equilibria of body constituents are described. Measurements on irreversible and reversible processes, together with evaluation of renewal and dilution values, are also reported. (J.S.R.)

7721 TECHNIQUES OF RADIOACTIVE MEASUREMENTS. C. Giuntini. p.363-99 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The instruments used in the measurement of radioisotopes—ionization detectors, scintillation detectors, photomultipliers, accessory instruments, counters, and special apparatus—are described. The evaluation of statistical errors in the radiation measurements is reviewed. Techniques of in vitro and in vivo counting are discussed in some detail. (J.S.R.)

7722 AUTORADIOGRAPHY. F. Gavosto. p.401-45 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The theoretical hypothesis for autoradiography is reviewed, and the requisite properties of the photographic emulsion are described. The problems of technique that must be solved are summarized with an indication of their solution. Factors used in the inspection of the autoradiographic preparation and the principles of quantitative evaluation are given. (J.S.R.)

7723 RADIOISOTOPES IN THE STUDY OF MATERIAL EXCHANGE. O. Ferrini and P. Biassoni. p.453-76 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

Tracer techniques are extensively used in the study of intermediary exchange and in the evaluation of the organism composition. Measurement of the hydro-mineral exchange of sodium, potassium, chlorine, and calcium and the determination of cellular water were described. Protein exchange was also considered. (J.S.R.)

7724 RADIOISOTOPES IN NEUROSURGICAL DIAGNOSTICS. P. E. Maspes and C. A. Pagni. p.477-92 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

Radioisotopes are used in neurosurgery for the diagnosis of expansive endocranial processes and for the study of fluid dynamics and of hydrocephalics. A review is presented of work done in this field. (J.S.R.)

7725 RADIOISOTOPES IN CARDIOANGIOLOGY. G. Gigli. p.493-526 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

A review is presented of the use of radioisotopes in cardioangiological studies. A review is made of the techniques and results obtained in radiocardiograms, the determination of the circulatory power and time, and functional exploration of the peripheral circulation. (J.S.R.)

7726 RADIOISOTOPES IN GASTROENTEROLOGIC DIAGNOSIS. O. Ferrini and M. Gestagno. p.527-53 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The most important uses of radioisotopes in gastroenterological diagnosis are in studies of intestinal absorption and of hepatic functions. A review is presented of studies made in these two areas with an indication given of other applications in gastroenterology. (J.S.R.)

7727 RADIOISOTOPES IN HEMATOLOGICAL DIAGNOSIS. O. Ferrini and G. L. Perroni. p.555-86 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The application of radioisotopes in hematological diagnosis is directed, on one hand, to the study of the survival and distribution in the organism of erythrocytes and of other hematic cells and, on the other hand, to determine the modality with which erythropoiesis proceeds. A review is made of studies made on the determination of the hematic volume, survival of erythrocytes and platelets, ferrokinetics, and absorption of B_{12}. (J.S.R.)

7728 RADIOISOTOPES IN THYROID DIAGNOSIS. A. Costa. p.587-645 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The use of radioisotopes in the study of thyroid function is reviewed. The topics discussed are determination of percentage uptake, urinary elimination of radioiodine, thyroid clearance, renal clearance of iodine, salivary elimination of iodine, rate of organic radioactivity of iodine in plasma, conversion ratio, calculation of parameters of thyroid function, thyroid scanning, autoradiography, radiochromatography, and radioelectrophoretic graphs. (J.S.R.)

7729 APPLICATIONS OF RADIOISOTOPES IN ENDOCRINOLOGICAL DIAGNOSIS (EXCLUDING THYROID). O. Ferrini and M. Bestagno. p.647-60 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The tracer techniques used and results found in endocrinological studies other than thyroid studies are reviewed. The topics discussed are biological determination of pituitary stimulation, biological determination of mineral corticoid activity, steroid determination, steroid metabolism, diabetic studies, and osteopathic studies. (J.S.R.)

7730 APPLICATIONS OF RADIOISOTOPES IN OBSTETRICAL AND GYNECOLOGICAL DIAGNOSIS. G. Tesauro. p.661-70 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

A review is given of tracer methods for the diagnosis of obstetrical and gynecological disorders. (J.S.R.)

7731 RADIOISOTOPES IN NEPHROLOGY. G. Monasterio. p.671-5 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The use of radioisotopes in tests of kidney function is briefly reviewed, and an indication is given of the results obtained. (J.S.R.)

7732 RADIOISOTOPES IN OPHTHALMOLOGY. A. Santoni. p.677-85 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The use of radioisotopes in the diagnosis and therapy of ophthalmological disorders is briefly reviewed. (J.S.R.)

7733 RADIOISOTOPES IN ONCOLOGICAL DIAGNOSIS. G. Monasterio. p.687-96 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The use of radioisotopes in the location and diagnosis of tumors of the thyroid, cerebrum, digestive tract, and other organs is reviewed. (J.S.R.)

7734 THE TREATMENT OF HEMATOLYMPHOPATHY WITH RADIOISOTOPES. W. Paolino and L. Resegotti. p.707-34 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The radiotherapy of blood and lymph disorders with radioisotopes is reviewed. The characteristics of radiosulfur are discussed as an introduction to a consideration of its use in the therapy of polycythemia vera, leukemia, lymphosarcoma, Hodgkin's disease, plasmocytoma, and multiple myeloma. Then the characteristics of radioisotopes in colloidal form, radioarsenic, and radiobismuth were described. (J.S.R.)

7735 RADIOIODINE IN THE THERAPY OF HYPERTHYROIDISM. A. Costa. p.735-61 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The pathological anatomy of hyperthyroidism is reviewed as a introduction to its therapy. The elective indications of treatment and counter indications are indicated. The course of therapy and its inconveniences are discussed with a summary of the results obtained. (J.S.R.)

7736 RADIOIODIDE IN THE TREATMENT OF CANCER OF THE THYROID. A. Costa. p.763-86 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The results of studies on the treatment of thyroid cancer with radioiodine are reviewed. The treatment indications, evaluation of metastasis, radioiodine dose administered, inconveniences and dangers of treatment, and the therapy results are discussed. (J.S.R.)

7737 RADIOIODINE IN THE THERAPY OF HEART DISEASE. G. Magri and N. Tedeschi. p.787-98 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The treatment of angina pectoris and cardiac insufficiency with radioiodine is reviewed. The indications and counter indications for such treatment, the therapeutic technique, and the results obtained are discussed. (J.S.R.)

7738 RADIOISOTOPES IN UROLOGICAL THERAPY. C. Picchio. p.799-813 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The techniques, radiation dose, reactions, and results in the radioisotopic treatment of neoplasms of the bladder and prostate are reviewed. (J.S.R.)

7739 THE ENDOPERITONEAL AND ENDOPLEURAL APPLICATIONS OF RADIOCOLLOIDS. B. Bellion. p.815-38 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The injection of radiocolloids for the treatment of peritoneal and pleural neoplasms has increased greatly in recent years. A review is presented of the physical properties of various radioisotopes, radiobiological considerations on their injection, injection techniques, dosimetry and protection, indications, counter indications, and inconveniences. (J.S.R.)

7740 RADIOCOLLOIDS IN GYNECOLOGICAL THERAPY. A. Barbanti. p.839-68 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

A review is presented on the use of radiocolloids in gynecological therapy. The anatomical, physiopathological, and radiobiological bases of such therapy are described. The most commonly used techniques and isotopes are tabulated, and the indications and counter indications for their use are given. (J.S.R.)

7741 LOCAL APPLICATIONS OF RADIOISOTOPES. O. Ferrini and A. Dorigoni. p.869-76 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The three principal types of local application of radioisotopes are surface or contact, endocavity, and interstitial (either by infusion or infiltration). The techniques and results used in these three types are briefly summarized. (J.S.R.)

7742 ISOTOPE THERAPY BY ENDOARTERIAL METHODS. p.877-90 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

Experiments on the arterial injection of Y^{90} and Au^{198} for the treatment of renal and other tumors are reported. It is shown that the arterial injection method has the advantage of a uniform distribution of the radioisotope. The treatment does not give a general disturbance of the organism, and only locally are poor symptoms of varying degree experienced. The low doses given show no evidence of causing anatomic damage. (J.S.R.)

7743 THE USE OF RADIOISOTOPES AS "SEALED SOURCES." A. Ruffo. p.891-902 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

The implantation of radioisotopes in sealed containers at the site of a neoplasm where it will not pass into the blood circulation or into the host tissue is reviewed. The two isotopes discussed are Au^{198} and Y^{90}. (J.S.R.)

7744 TELEISOTOPE THERAPY. C. Sinistrero. p.903-38 of "Diagnostica e Terapia con i Radioisotopi." Turin, Edizioni Minerva Medica, 1962.

Teletherapy using high energy isotope sources is reviewed. Co^{60} and Cs^{137} sources together with the teletherapy apparatus are described. The treatment and control rooms are also considered. The physical and biological advantages of radioisotopic sources in radiotherapy are tabulated. Dosimetry in radiotherapy and the treatment methods are described. A discussion is presented of the clinical indications for teletherapy and the general and local reactions from it. (J.S.R.)

7745 MEANS FOR THE TREATMENT OF CAVITIES IN THE HUMAN BODY WITH BETA AND GAMMA RADIATION, AND METHOD OF MAKING SAME. Karl Heinz Rummert. British Patent 913,479. Dec. 19, 1962. Filed Dec. 20, 1956.

Iridium or Hf is distributed on the wall of the bulb or in the tubular part of a catheter. The Ir or Hf is subsequently activated in a reactor, preferably by neutron bombardment. (R.J.S.)

7746 EXPERIMENTAL ANIMAL MAINTENANCE. Miriam P. Finkel (to U. S. Atomic Energy Commission). U. S. Patent 3,074,375. Jan. 22, 1962.

A method of housing experimental animals such as mice in individual tube-like plastic enclosures is described. Contrary to experience, when this was tried with metal the mice did not become panicky. Group housing, with its attendant difficulties, may thus be dispensed with. (AEC)

Biochemistry, Nutrition, and Toxicology

7747 (BNL-5976) RADIOACTIVE ISOTOPES—METABOLIC, DIAGNOSTIC AND THERAPEUTIC USES. Lee E. Farr and O. D. Easterday (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT-30-2-GEN-16]. 49p.

Medical uses of radioisotopes are reviewed. Radioisotopes have been used to yield information with respect to the maintenance of circulatory integrity, the maintenance of adequate excretory ability and capacity, the capability of physical injury repair, the normality as well as the abnormality of gastrointestinal tract function, better placement of materials in specific centers of the central nervous system with particular reference to ultimate therapeutic action, and in diagnosis and therapy of neoplasia. 328 references. (C.H.)

7748 (HW-SA-2600) PRELIMINARY OBSERVATIONS ON METABOLISM AND TOXICITY OF PLUTONIUM IN MINIATURE SWINE. L. K. Bustad, W. J. Clarke, L. A. George, V. G. Horstman, R. O. McClellan, R. L. Persing, L. J. Seigneur, and J. L. Terry (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [June 5, 1962]. Contract AT(45-1)-1350. 15p.

The toxicity of Pu was investigated in miniature swine. Results are summarized from studies of blood concentration, organ burden, and excretion patterns following various routes of Pu administration, the toxicity of Pu as compared to some other bone-seeking nuclides, and the penetration and removal of Pu from skin when injected or applied topically. (C.H.)

7749 (TID-17421) RADIOCHEMICAL STUDIES WITH ETHYLENE IN PLANT METABOLISM. Final Research Report. Wayne C. Hall (Texas. Agricultural Experiment Station, College Station). Oct. 25, 1962. Contract AT(40-1)-2456. 17p.

Ethylene generally stimulated specific enzyme systems at low concentrations. There was an influence on the swelling of mitochondria and increased deplasmolysis of cells. Ethylene was absorbed readily by the leaves and roots of both susceptible and resistant plants, as well as by fruit; however, relatively small quantities were actively fixed. The fixed quantities were not re-distributed but were released to the atmosphere slowly with time after treatment. This process could be hastened considerably by elevated temperatures. There was no major influence of ethylene on the dark fixation of carbon dioxide by intact plants. Ethylene-mercuric-perchlorate complex formation was accompanied by conversion of the ethylene to various reactant products. These reactant products acted as a readily utilizable carbon source for dark fixation but did not enter by the same mechanism as carbon dioxide. In intact plants, ethylene was apparently not produced in any great quantities by the beta oxidation of fatty acids. Although 2,4-D stimulated the production of ethylene by plants (during formative response to the regulator), the molecule itself was not utilized as a direct source of ethylene. In P. digitatum, serine did not support growth, but was metabolized to ethylene. The C-2, and particularly the C-3 of serine was incorporated into the ethylene molecule, possibly through the glyoxylate cycle. (auth)

7750 (TID-17547) METABOLISM AND REMOVAL OF RARE EARTHS IN MAN. Herta Spencer, [D.] Laszlo, and Betty Rosoff (Veterans Administration Hospital, Hines, Ill.). [1962]. Contract AT 30-1 -1763. 34p.

Rare earth isotopes are by-products of nuclear fission and may constitute a source of internal radiation after accidental exposure. These elements form tight complexes with nucleic acids and have been suggested as useful diagnostic tools and therapeutic agents in neoplasia. Following animal experiments, studies of the metabolism and removal

of rare earths were performed in humans in good physical condition with normal renal function. Tissue distribution studies were performed on patients with advanced neoplastic disease. Data are presented on the metabolism of La^{140}, Y^{90}, Y^{91}, and Sc^{46} in man. The metabolism of rare earths in man was found to vary with the chemical form administered, ionic or chelated. The excretion of a metal administered in chelated form appeared to depend on the competition between the chelating agent and body competitors for the metal. Factors that influence the tissue distribution of rare earths are discussed. The chelating agents, EDTA and DTPA, were both found to be effective in removing radioactive rare earths from man. The chance for effective removal was found to be greater the sooner therapy was instituted after exposure. (39 references.) (C.H.)

7751 (TID-17552) THE INHERITANCE AND CHARACTERISTICS OF DIFFERENTIAL ELEMENT ACCUMULATION BY MAIZE WITH PARTICULAR EMPHASIS ON STRONTIUM AND CALCIUM. Annual Progress Report. (Pennsylvania State Univ., University Park). Nov. 1962. Includes Appendices 1, 2, and 3. Contract AT(30-1)-2744. 26p.

Approximately 5300 samples of maize plant materials were analyzed spectrochemically for 12 elements. Individual leaves of parental lines, F_1 single crosses, F_2 progenies and reciprocal backcrosses from inbred lines determined to be genetically different were analyzed for differences in chemical content. Preliminary results are included from a study on the effects of Ca and Al in the substrate on the absorption of Sr by different genetic stocks. (C.H.)

7752 DISTRIBUTION OF RADIORUTHENIUM IN MICE. Arne Nelson, Sven Ullberg, Harry Kristoffersson, and Curt Roennbaeck (Research Inst. of National Defence, Sundbyberg, Sweden and Royal Veterinary Coll., Stockholm). Acta Radiol., 58: 353-60(Oct. 1962). (In English)

The distribution of ruthenium-103 in sections through whole male and pregnant female mice was investigated by autoradiography at different times after injection. A marked and consistent affinity of ruthenium for connective tissue was observed. Its passage to the central nervous system and the fetus was blocked but a considerable accumulation in the fetal membranes was noted. The only route of excretion was by the kidneys. (auth)

7753 TOXICITY AND METABOLISM OF ORTHO-, META-, AND PARA-TERPHENYLS. Herbert H. Cornish, Raymond E. Bahor, and Richard C. Ryan (Univ. of Michigan, Ann Arbor). Am. Ind. Hyg. Assoc. J., 23: 372-8(Sept.-Oct. 1962).

A study of the acute oral toxicity of ortho-, meta-, and para-terphenyl in rats resulted in LD_{50} values of 2400, and greater than 10,000 mg/kg, respectively. Thirty day feeding studies suggest that continued ingestion of these compounds may produce liver and kidney damage. Metabolic studies indicate that the major metabolites of ortho- and meta-terphenyl are glucosiduronic acids and phenols. Paraterphenyl was poorly absorbed and a large portion is excreted unchanged in the feces. (auth)

7754 STORAGE AND EXCRETION OF LEAD 210 IN DOGS. Stuart C. Black (Univ. of Rochester, N. Y.). Arch. Environ. Health, 5: 423-9(Nov. 1962).

Beagle dogs were exposed to an atmosphere containing radon and its radioactive daughters. Excretion of the resulting radiolead was determined over a long period of time by analysis of urine and feces for Pb^{210} and analysis of tissues at the end of the experiment. Initial urinary Pb^{210} excretion did not correlate with either the amount of Pb^{210} deposited in the lungs or the amount in the whole body. However, the amount of Pb^{210} stored in the skeleton was proportional to Pb^{210} deposited in the lungs. Application of the findings in determining the radiation exposure of man from inhaled radon by analysis of urine for Pb^{210} are discussed. (C.H.)

7755 EDETATE KIDNEY LESIONS IN RATS. Melvin D. Reuber (Beth Israel Hospital, Boston and Harvard Medical School, Boston) and George C. Schmieler. Arch. Environ. Health, 5: 430-6(Nov. 1962).

Lesions simulating versene nephrosis in human beings were produced in rats with disodium ethylenediaminetetraacetate. Rats were injected intraperitoneally with varying dosages of Na edetate, Ca edetate, or Pb edetate and killed at different time intervals. Some rats were given daily injections for 21 days and then killed 2 weeks after completion of the injections. Na edetate, in 400 and 500 mg doses, produced severe hydropic degeneration of the proximal convoluted tubules of the kidney in all rats. Calcium disodium ethylendiaminetetraacetate (Ca edetate) in the 500 mg dose produced only minimal focal hydropic changes in 58% of animals. The lesions had almost disappeared 2 weeks after the Ca edetate had been stopped. All rats given lead disodium ethylenediaminetetraacetate (Pb edetate) developed mild focal changes. The degeneration in the rats given Pb edetate was followed by regeneration of cells lining the proximal convoluted tubules. Lesions developed more slowly with lower dosages of Ca edetate and Na edetate and were reversible even though the injection of the drugs was continued. (auth)

7756 COMPARATIVE TOXICITY OF STABLE RARE EARTH COMPOUNDS. II. EFFECT OF CITRATE AND EDETATE COMPLEXING ON ACUTE TOXICITY IN MICE AND GUINEA PIGS. Joseph G. Graca, Frederick C. Davison, and Joyce B. Feavel (Ames Lab., Ames, Iowa). Arch. Environ. Health, 5: 437-44(Nov. 1962).

Intraperitoneal injections of rare earth chlorides, citrates, and edetate (EDTA) complexes in mice and guinea pigs produced graded toxic reactions in the animals in doses from 25 mg per kilogram to 500 mg per kilogram. Chloride toxicity was difficult to evaluate because of hydrolysis and precipitation at the site of injection with subsequent development of peritonitis. The citrates and edetate complexes are absorbed from the injection site and show a general pattern of decreasing toxicity from the lower to the higher lanthanons. Gross and histopathological examination of bone marrow (sternal), liver, kidney, spleen, adrenals, sex organs, lungs, myocardium, and mesenteric lymph nodes indicate that lesions, when found, were similar for all rare earths. There appears to be a predilection for liver and kidney. Citrates produce an acute passive congestion of lungs and liver within 4 hours after injection, which is of a transitory nature, Renal changes are found later but not consistently. In general, the citrates were more toxic than the edetate complexes. (auth)

7757 ON THE DETERMINATION OF CRITICAL ORGANS BY INTERNAL USE OF RADIOACTIVE-LABELED COMPOUNDS. H. Kutzim (Universität, Cologne). Atomkernenergie, 7: 487-8(Dec. 1962). (In German)

By way of some examples, it is shown that the quantitative auto-radiography of whole animals is particularly suited for determining the critical organ after administration of radioactively labeled compounds. It is pointed out that it is not possible, in general, to determine the critical

organ for a radionuclide. The structure of the chemical compound is of decisive importance for the organ affinity. The critical organ must be determined separately for each radioactively labeled compound. (auth)

7758 ISOLATION OF MULTILABELLED NUCLEOTIDES BY MEANS OF BIOSYNTHESIS. H. Altmann and G. Stehlik (Institut für Biologie und Landwirtschaft, Reaktorzentrums, Seibersdorf, Ger.). Atompraxis, 8: 471-2 (Dec. 1962). (In German)

Radiophotosynthesis was used to incorporate $C^{14}O_2$ into plants. After isolation of the nucleic acids, the remaining plant fractions were converted into a nutrient substrate, which, together with a carrier-free solution of radioactive phosphate, was then added to a yeast suspension. The 2′ 3′ ribonucleotides of the RNA, which were labeled with P^{32} and C^{14}, were isolated from the nucleic acids obtained from the plants and yeast, and then purified. In addition, the doubly labeled free nucleotides were also removed from the yeast. (auth)

7759 RADIOCRYSTALLOGRAPHIC DATA ON THE INCORPORATION OF FLUORINE INTO BONY MINERAL SUBSTANCES IN VIVO. Charles-Albert Baud and Sabine Slatkine (Institut de Morphologie, École de Médecine, Geneva). Compt. Rend., 255: 1801-2(Oct. 8, 1962). (In French)

The radiocrystallographic analysis of a series of bones fluorided in vivo proves that the fluorine is incorporated into the crystalline cell of the bony mineral substance; the hypothesis of a transformation of the carbonatohydroxylapatite into carbonatofluoroapatite is confirmed. (tr-auth)

7760 THE ASSIMILATION OF TAGGED AMINO ACIDS AND OF ADENINE-8-C^{14} BY NUCLEOTIDPEPTIDES OF THE BAKING YEAST SACCH. CEREVISIAE. M. K. Veinova and N. M. Sisakyan (Bakh Inst. of Biochemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 147: 731-4 (Nov. 21, 1962). (In Russian)

The amino acids, glycine-C^{14}, lysine-C^{14} and threonine-C^{14}, and adenine-8-C^{14} were used as tracers. A volume of 10 ml of 0.3M sugar, and 200 μg of tracer amino acid (4 μC) were added to 25 g of yeast, which was then incubated for 10, 30, and 120 min at 30°C. A nucleotidpeptide fraction was then isolated, and counted for its beta activity. Blank corrections were made by running a control experiment where the precipitating reagent was added immediately after the tracer amino acid was added to the yeast. The amount of lysine-C^{14} assimilated by the nucleotidpeptide fraction was greater than that assimilated by the acetone-soluble fraction or the protein fraction. Lysine-C^{14} was first taken up rapidly by the nucleotidpeptide fraction and the acetone-soluble fraction, but then dropped off with further incubation. The content of lysine-C^{14} in the protein fraction rose during the course of the experiment. Amino acids such as threonine, tyrosine, tryptophan, and phenylalanine can bypass the nucleotidpeptide stage in undergoing protein synthesis. Adenine-8-C^{14} is rapidly assimilated by the nucleotidpeptide fraction, and also is subjected to rapid turn-over, as shown by the decrease in activity on adding adenine-C^{12}. Studies on explaining the role of the nucleotidpeptides in protein synthesis are continuing. (TTT)

7761 A LITTER-BAG METHOD FOR THE STUDY OF MICROARTHROPODS INHABITING LEAF LITTER. D. A. Crossley, Jr. and Mary P. Hoglund (Oak Ridge National Lab., Tenn.). Ecology, 43: 571-3(1962).

A botanical method is described for use in sampling leaf litter in studies of succession of microarthropod species. This method uses fresh leaf litter in net bags that are placed on the forest floor. Sampling at intervals permits estimates of the rates of breakdown of the litter. During such studies it was found that microarthropods invade the bags freely and can be extracted with Tullgren funnels. An analysis of data indicated that the bags tended to produce high populations. The use of dm^2 litter bags was found to produce best results for quantitative sampling for Tydeus sp. and possibly other species. (C.H.)

7762 COMPARATIVE METABOLISM OF RADIONUCLIDES IN MAMMALS. I. UPTAKE AND RETENTION OF ORALLY ADMINISTERED Zn^{65} BY FOUR MAMMALIAN SPECIES. C. R. Richmond, J. E. Furchner, G. A. Trafton, and W. H. Langham (Los Alamos Scientific Lab., N. Mex.). Health Phys., 8: 481-9(Oct. 1962). (LADC-5272)

Uptake and retention of a single oral administration of $Zn^{65}Cl_2$ in mice, rats, dogs, and 4 human subjects were studied by whole-body counting methods. Retention functions for each species were accurately represented by multiple rate equations composed of three exponential terms. The average effective half-time of the longest component (which accounts for approximately 95% of all the disintegrations occurring in the body) of the retention curve for man was 154 days with a range of 149 to 161 days. A parabolic relationship between species weight and equilibrium level for chronic exposure was derived and used to estimate Zn^{65} $(MPC)_w$ values for man. The average $(MPC)_w$ value (168 hr/week exposure) obtained directly from the human data by usual methods was 3.1×10^{-4} μc/ml with a range of 1.7 to 4.7×10^{-4} μc/ml compared with 2.4×10^{-4} μc/ml when derived from interspecies correlation data. (auth)

7763 THE ELEMENTARY COMPOSITION OF HUMAN CORTICAL BONE. Helen Quincy Woodard (Sloan-Kettering Inst., New York). Health Phys., 8: 513-17(Oct. 1962).

Determinations were made of the specific gravity and of the calcium, phosphorus, nitrogen, and water content of specimens of human cortical bone. The results were found to show small but consistent variations with the ages of the subjects. A type specimen was therefore constructed from the averages of the observed figures from the bones of four young adult men. Values for oxygen, hydrogen and carbon were derived from the amounts of compounds of these elements which were known to be present. The amounts of sodium, magnesium and sulfur were obtained from the literature. A table of the average elementary composition of adult human cortical bone was prepared from this material. This table is suitable for use in computing the absorption of ionizing radiation by this substance. Problems in the computation of energy absorption in spongiosa are discussed. (auth)

7764 SYNTHESIS OF PENICILLINS FOR TRACER STUDIES. D. E. Nettleton, Jr., D. L. Johnson, F. A. O'Herron, and I. R. Hooper (Bristol Labs., Syracuse, N. Y.). Intern. J. Appl. Radiation and Isotopes, 13: 259-61 (May 1962). (In English)

The synthesis of Penicillin K, Penicillin X, Penicillin F and its dihydro derivative, and C^{14}-labeled benzylpenicillin are described, starting from preparations containing 6-aminopenicillanic acid. (T.F.H.)

7765 UTILIZATION OF TRITIATED HISTIDINE (H^3HIL) BY SKELETAL CELLS OF ADULT MICE. Edgar A. Tonna and Eugene P. Cronkite (Brookhaven National Lab., Upton, N. Y.). J. Gerontol., 17: 353-8(Oct. 1962). (BNL-6107)

The uptake and utilization of tritiated histidine by 1-year-old mice was followed up to 14 days autoradio-

graphically. Results showed that very little histidine uptake and turnover occurred and that there apparently was no distinction in protein metabolic activity between different cell types at this age, except for a group of chondrogenic cells within the perichondrial zone of the periosteum. These results were compared with the data of 2-week-old mice previously reported. (auth)

7766 AN AUTORADIOGRAPHIC STUDY OF THE LOCALIZATION AND DISTRIBUTION OF TRITIATED HISTIDINE IN BONE. E. A. Tonna, E. P. Cronkite, and M. Pavelec (Brookhaven National Lab., Upton, N. Y.). J. Histochem. Cytochem., 10: 601-10(Sept. 1962). (BNL-6025)

The localization, distribution, and cellular turnover of tritium labeled-histidine was followed autoradiographically in the femora of young mice. Initially the labeled amino acid was taken up by the cellular phase of the skeletal system within the first hour after isotope administration. From 1 to 4 hours, intracellular histidine appeared within newly deposited cartilage and bone matrix. By 14 days skeletal cells had lost their label, however, red blood cells were still labeled at 14 days. (auth)

7767 RADIOACTIVITY IN TOTAL DIET. Irving Michelson, John C. Thompson, Jr., Betsey W. Hess, and C. L. Comar (Consumers Union of U. S., Inc., Mount Vernon, N. Y. and Cornell Univ., Ithaca, N. Y.). J. Nutr., 78: 371-83(Dec. 1962).

Total diet samples collected in 1961 from 10 to 25 major cities were analyzed for radionuclides arising from nuclear debris (Sr^{90}, Cs^{137}, Ce^{144}, Pu^{239}, Zn^{65}), for natural radioactivity (Ra^{226}, Pb^{210}, K^{40}), and for the stable nuclides of Ca and K. The variability arising from collection of samples was not greater than that due to analytical procedures. Levels of Sr^{90} in the total diet ranged from 2 to 15 $\mu\mu c$/gm of Ca. Values in the West, with the exception of the Far Northwest, tended to be lower, but no marked differences were observed among other geographical regions. The Sr^{90}/gm Ca values for adult diets, presumably because of their lower milk content, were higher than for infant and teenage diets. The values of Sr^{90}/gm of Ca for the total diet were about 1.6 times those for the milk contained in the diet. It was calculated that 54% of the total Sr^{90} intake came from dairy products, on the assumption that 75% of the Ca originated from this source. The daily intake of Ra^{226} was estimated to be about 2 $\mu\mu c$ in teenage and adult diets, and about 1 $\mu\mu c$ in infant diets. Average daily intakes of the various radionuclides expressed in micromicrocuries, were as follows: K^{40}, 4,000; Cs^{137}, 50; Sr^{90}, 10; Ce^{144}, 4; Pb^{210}, 4; Ra^{226}, 2; Pu^{239}, 0.1. (auth)

7768 DTPA — FOLLOW-UP STUDIES OF EFFECTIVENESS IN LONG-TERM ADMINISTRATION FOR PLUTONIUM IN A SINGLE HUMAN CASE. W. D. Norwood (General Electric Co., Richland, Wash.). J. Occupational Med., 4: 130-2(Mar. 1962). (HW-SA-2240)

The average daily urinary output of plutonium was increased initially by a factor of 55 by the intravenous administration of DTPA to an employee who had received a deposition of about 0.4 microcurie 30 months previously. As treatment was continued, intermittently, the effectiveness gradually decreased until at the end of 50 weeks it was only 20 per cent of that initially observed. However, when therapy was stopped for several months and then resumed, the daily output of urinary plutonium was again increased to approximately the intitial value attained with therapy. Alkalization of the urine produced to apparent change in the therapeutic effectiveness of DTPA in this single case. The effectiveness of DTPA in increasing plutonium output in feces was likewise enhanced by the long period of no therapy. (auth)

7769 THE METABOLISM OF INHALED MERCURY VAPOR IN THE RAT STUDIES BY ISOTOPE TECHNIQUES. Alastair D. Hayes and Aser Rothstein (Univ. of Rochester, N. Y.). J. Pharmacol. Exptl. Therap., 138: 1-10(Oct. 1962).

The metabolism of inhaled mercury vapor in the rat was studied, using Hg^{203} as a tracer, following short periods of exposure ($\frac{1}{2}$ to 5 hours) in a specially constructed exposure unit. The distribution and excretion patterns are remarkably similar to those obtained with $HgCl_2$ given by intravenous or intramuscular injection. The only major difference associated with the inhalation route is a transient, high level in the lungs, that clears with a half-time of 5 hours. By calculation from assumed minute volumes, virtually all of the inhaled mercury vapor is apparently deposited in the lung, there oxidized to ionic form and absorbed by the blood within a matter of hours. About 30% of the metal is cleared from the body rapidly (half-time, 2 days) and the rest more slowly (half-time, 20 days). The rapid phase is associated with a transient, rapid fecal excretion, the slow phase with approximately equal rates of fecal and urinary excretion. Apart from the transient high levels in the lung, mercury is uniformly distributed in all tissues except the kidney. After 15 days, the latter organ has accumulated 70% or more of the body burden. On a per gram basis, the kidney at that time contains 150 times as high a concentration of the metal as the other tissues. The extraordinary affinity of the kidney for mercury is not related to filtration phenomena. (auth)

7770 ISOTOPIC OXYGEN INCORPORATION IN XANTHOPHYLLS OF SPINACEA OLERACEA QUANTASOMES. Elie A. Shneour and Melvin Calvin (Univ. of California, Berkeley). Nature, 196: 439-41(Nov. 3, 1962).

The incorporation of O^{18} in xanthophylls of quantasome aggregate fractions of Spinacea oleracea was investigated. These fractions can evolve oxygen in the presence of a suitable electron acceptor, but lack the ability to fix carbon dioxide. Results showed that very little O^{18} appeared in either lutein or violaxanthin, the two xanthophylls examined. The technique was tested by the use of the carotenoid spheroidenone of the photosynthetic bacterium Rhodopseudomonas spheroides in an O^{18} atmosphere. The label was incorporated into the compound in substantial amounts. The role of carotenoids in general, and xanthophylls in particular, in photosynthetic organisms is discussed. (C.H.)

7771 CAESIUM-134 IN MAN IN SCANDINAVIA. D. V. Booker and A. C. Chamberlain (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature, 196: 489-90 (Nov. 3, 1962).

After the Windscale accident of October 1957 a number of samples of milk, grass, and soil were taken from the surrounding district and analyzed by γ-spectrometry for I^{131}, Co^{137}, and Ba^{137}. Results show that the patterns of deposition of these two isotopes were very similar. The ratio of activities of I^{131} to Cs^{137} worked back to the time of the accident was close to 50:1. The activity of Co^{134} released in the accident was known to be less than 5% of the activity of Cs^{137}. Analysis of the data led to the conclusion that Cs^{137} recently found in inhabitants of Lapland cannot be attributed to the Windscale accident. (C.H.)

Fallout and Ecology

7772 (NYO-9533) STUDIES OF NUCLEAR DEBRIS IN PRECIPITATION. Alan Walton and Micah W. M. Leo

(Isotopes, Inc., Westwood, N. J.). Nov. 15, 1962. Contract AT(30-1)-2415. 55p.

A study has been made of the deposition of radioactive fallout at Westwood, N. J., immediately prior and immediately following the atmospheric tests of 1961. Before Sept. 1961, the major sources of radioactivity were the Pacific tests of 1958 while in the first six months of 1962 these same detonations contributed about one-tenth of the deposition of Sr^{90} at Westwood, N. J. The U.S.S.R. test series of late 1961 were responsible for the remainder of the debris in 1962. The total deposits of Sr^{90} during the first six months of 1962 and 1959 were almost equal at 20 mc/mi^2. Knowing the contributions of U.S.S.R. debris to the total fallout in 1959 and 1962 and the worldwide deposition of U.S.S.R. material from 1958 tests, it is calculated that about 1 MC of 1961 U.S.S.R. Sr^{90} has been deposited over the earth's surface to date. It is also suggested that the estimated total yield of 2.5 MC may be about 20% high. Rhodium-102, a unique tracer for U. S. high altitude detonations in Aug. 1958, has been detected and monitored in precipitation since Oct. 1960. Between Jan. 1961 and the resumption of atmospheric tests in Sept. 1961 the contribution of high altitude debris to the total deposition has been increasing. From the Westwood data, a crude calculation of the worldwide deposit of Rh^{102} activity has been made. The result of 0.1 MC is to be compared with the estimated yield of total Rh^{102} activity from the high altitude burst of 3 MC. Other data tend to suggest that this estimated yield is excessively high. (auth)

7773 (NYO-9934(Vol.I)) STRONTIUM-90 IN MAN AND HIS ENVIRONMENT. VOLUME I. SUMMARY. Final Report. J. Laurence Kulp and Arthur R. Schulert (Columbia Univ., Palisades, N. Y. Lamont Geological Observatory. Geochemistry Lab.). May 1962. Contract AT(30-1)-1656. 401p.

Results are summarized from an investigation of the concentrations of Sr^{90} in man and his environment. Emphasis is placed on data accumulated from 1959 through 1962. Processes by which contamination occurs are elucidated. Data are included from atmospheric and geochemical studies, factors affecting the distribution of Sr^{90} on the earth's surface, and biochemical studies on the movement of Sr^{90} through the food chain to man. Theoretical models of the concentration of Sr^{90} in the human population that adequately fit the experimental data are presented. It is concluded that reasonable predictive ability has been achieved. The results are used to estimate future concentrations of Sr^{90} in man resulting from further atmospheric testing of nuclear weapons or as the result of a nuclear war. 142 references. (C.H.)

7774 (TID-15870) CONTAMINATION OF PLANT FOLIAGE WITH RADIOACTIVE FALLOUT. E. M. Romney, R. G. Lindberg, H. A. Hawthorne, B. G. Bystrom, and K. H. Larson (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). Apr. 27, 1962. Contract AT-04-1-Gen-12. 31p.

Studies of foliage contaminated with fallout from nuclear detonations showed that fallout particles less than 44 μ diameter were selectively trapped in the hairs and crevices and on resinous glands of the leaf surfaces. The beta activity from fallout lodged on plant foliage was correlated with the beta activity from fallout particles less than 44 μ diameter which were deposited downwind from the nuclear detonations. Although decontamination treatments did not remove all fallout particles from plant foliage, the levels of radioactivity which remained were less than half of the original after washing with mild detergents and chelating agents. Fallout on plant foliage that originated from tower-supported detonations was 5 to 35% soluble in 0.1 N HCl; fallout from balloon-supported detonations was 60 to 90% soluble. Radioisotopes of cerium, yttrium and zirconium contributed about 60% of the beta activity found in smaller than 44 micron-diameter fallout particles (90 days after detonation); radiostrontium accounted for nearly 5% and radiocesium contributed less than 1%. (auth)

7775 MEASUREMENT OF ^{137}Cs CONCENTRATION IN THE SEA WATER OF OSAKA BAY. Kazuko Yoshikawa, Tetsuo Mamuro, and Toshio Azuma. Ann. Rept. Radiation Center Osaka Prefect., 2: 20-3(1961). (In English)

About 200 liters of surface water were collected on July 24, 1961, at a point near the center of Osaka Bay. The Cs^{137} concentration in this sample was determined to be 0.35 $\mu\mu$c/liter, as compared with 0.38 $\mu\mu$c/liter found by Yamagata for the surface sea water around Japan in 1959. (D.L.C.)

7776 ON THE VARIABILITY OF THE TERRESTRIAL COMPONENTS OF PENETRATING EXTERNAL ENVIRONMENTAL RADIATION IN THE OPEN AIR. W. Herbst and G. Huebner (Universität Freiburg i. B.). Atomkernenergie, 7: 481-6(Dec. 1962). (In German)

Of the many causes for the variability of terrestrial components of penetrating external environmental radiation, the following were examined in detail: geological environment; effects of road conditions; mining activity; vegetation, agriculture, and forestry; and fallout from nuclear weapon tests. The variability of natural total ground radiation is compared in the inhabited areas of southwest Germany and Switzerland. The average values vary between 100 and 180 mr/a in the two geographical areas, with extremes between 70 and 290 mr/a. (auth)

7777 THE EFFECT OF LIME APPLICATION ON THE Sr^{90} UPTAKE OF AGRICULTURAL FOOD PLANTS UNDER FIELD CONDITIONS. H. Reissig (Institut für Staubforschung and Radioaktive Schwebstoffe, Berlin and Technische Universität, Dresden). Kernenergie, 5: 678-84(Sept. 1962). (In German)

In 1959 and 1960 the effect of fractionated lime applications ($CaCO_3$) on the Sr^{90} uptake and the Sr^{90}/Ca ratio of various food plants were investigated under field conditions on a sandy soil with a low concentration of exchangeable Ca. With increasing lime the Sr^{90} uptake of the food plants per unit weight of dry material or ash was decreased. Of special significance was the effect of the lime application on the decrease of the Sr^{90}/Ca ratios of the food plants, since the percent Ca concentration in the plant ash was sharply increased with increasing lime application. A study was made on the calculation of the maximum possible decrease of the Sr^{90}/Ca ratios in plants by lime application under given soil poisoning with characteristic soil cation exchange capacity and concentration in exchangeable Ca. (tr-auth)

7778 IDENTIFICATION OF GAMMA-EMITTERS IN AIR BY SCINTILLATION SPECTROMETER. Tai-won Park, Tai-soon Kim, and Kyoung-suk Suo. Kwayon Hwibo, 5: 189-90(1960). (In Japanese)

In order to ascertain that the radioactivity due to fallout from weapons tests is below the MPC values, the concentrations of 8 radioisotopes, Zr^{95}, Nb^{95}, Ru^{103}, Ba^{140}, La^{140}, Ce^{141}, Ce^{144}, and Cs^{137}, in air were determined by means of a scintillation spectrometer from their γ-spectrum. The energy distribution was detected with the NaI phosphor of the scanning spectrometer. The air was passed through a filter at a rate of 20 ft^3/min after which the paper was ig-

nited and the ashes were analyzed. The Cs^{137} concentration was found to vary as a function of the climate, latitude, longitude, and altitude. The amount of Cs^{137} found in 6000 ft^3 of air was 82.8 μmc, equivalent to 1.38×10^{-2} $\mu mc/ft^3$. (TTT)

7779 RADIOCHEMICAL INTERPRETATION OF RADIOACTIVE FALL-OUT IN VEGETABLES. Tai-won Park, Tai-soon Kim, and Kyoung-suk Suo. Kwayon Hwibo, 5: 190-1(1960). (In Japanese)

The isotopes contained in vegetables are the same as in air because their radioactive contamination is due to dust or rain from the atmosphere. The concentration ratios, however, are changed because of selective absorption of the plants. Spinach and Chinese cabbage samples were digested with 6N HCl carrying out a chemical separation process with the solution and determining the various nuclides from their pulse-height spectrum obtained by means of a scintillation spectrometer. Results showed that K^{40} had the highest activity, followed by Zr^{95}, Nb^{95}, Cs^{137}, Ba^{140}, Ce^{141}, and Ce^{144}. (TTT)

7780 STUDIES ON FALL-OUT PARTICLES. [PART] I. Tetsul Mamuro, Akira Fujita, Tadao Matsunami, and Kazuko Yoshikawa (Radiation Center of Osaka Prefectural, Japan). Nippon Genshiryoku Gakkaishi, 4: 766-73(Nov. 1962). (In Japanese)

Highly radioactive fallout particles were found throughout Japan, resulting from the series of large scale nuclear test explosions carried out by U.S.S.R. during September and October 1961. The change of radioactivity in air-borne dusts since the beginning of these explosions and the changing aspect of fallout particles in the atmosphere during this period are shown. Many highly radioactive particles were collected and isolated from among numerous non-radioactive dust particles after elaborate procedures. Photomicrographs of them were taken and are shown. More than fifty highly radioactive particles was observed microscopically. Most of them were quite, or nearly, spherical. There were, however, a few particles which deviated appreciably from a sphere. The surface of some particles was irregular and creased. Several particles were coated with colorless amorphous materials like frosting. These materials were assumed to be non-radioactive because they had the same appearance as that of non-radioactive dust particles which were found numerously in air-borne dusts. Several particles had a few small particles of the same color attached on their surface. Almost all of the particles were yellowish, or reddish brown; however, there were some colorless, golden, or black particles. All the highly radioactive particles that could be isolated from among dust particles seemed to be so hard that an impact of a needle could not crack them into two or more particles. It was found that radioactivity is roughly proportional to volume. It seems that particles of light color have larger specific activity than those of dense color and that their conditions of particle formation were different from each other. (auth)

7781 THE FATE OF RADIOSTRONTIUM IN A FRESHWATER COMMUNITY. I. L. Ophel (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nov. 1962. 17p.

To be published in Radioecology, 1962.

A five-year study has been carried out on a small (100 acre) natural lake which receives water containing Sr^{90}. The Sr^{90} is leached from a nearby waste disposal area and has been entering the lake in low concentrations during the period of study. About 25% of the Sr^{90} that has entered the lake is retained within the lake ecosystem. Of this amount, 90% is present in the bottom materials. The dense aquatic vegetation in a marginal zone, covering almost one-third of the lake area, contains less than one per cent of the retained Sr^{90}. The fish population gradually accumulated Sr^{90}, reaching an equilibrium after four years' exposure. This true equilibrium is attained only when all the fish have spent their entire life in a contaminated environment. The resulting concentration factor is much higher than would be predicted from the experimental exposure of fish to Sr^{90} for short periods of time. Concentration factors for radiostrontium are given for other biota in the lake ecosystem. (auth)

7782 BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY NO. 28, JANUARY-MARCH, 1962. Tokyo, The Japan Meteorological Agency, 1962. 103p. (In English and Japanese)

Routine measurements on the fallout radioactivity made at 14 Japanese weather stations and two ships during January to March, 1962, are reported. These measurements include mean and maximum radioactivity of rain and radioactivity of dusts. (D.L.C.)

7783 AN INVESTIGATION OF THE ZINC AND ZINC-65 IN SHELLFISH OF FISHERS ISLAND SOUND AND ITS ESTUARIES. Bryant William Fitzgerald. Thesis, Storrs, Conn., Univ. of Connecticut, 1962. 88p.

The levels of Zn^{65} in the edible oyster (Crassostrea virginica) in Fishers Island Sound and its estuaries were investigated. In addition to the measurement of Zn^{65} in the samples, a colorimetric method was employed to establish the amount of total zinc in the tissue of the organisms. The samples used for the Zn^{65} and total zinc content of oysters were all collected from private oyster beds located in the Thames River (Connecticut). The samples were collected on a routine schedule from May 1960 to June 1961. The ability of oysters to concentrate zinc to the extent observed and the fact that little is known about the metabolism of zinc in oysters led to some laboratory investigations in regard to this matter. Oysters were placed in trays of contained sea water to which had been added various salts of zinc labeled with Zn^{65}. The effect of the different anions upon the rate and extent of zinc uptake was then followed by tracer techniques. In one instance, the labeled zinc added was chemically complexed. The results obtained indicated that the levels of Zn^{65} in oysters in this area are low in comparison to those obtained in samples from the West Coast of the United States. The results also demonstrated that the rate and extent of uptake of zinc by oysters is not effected by the anion with which it is associated. Complexation of the zinc will, however, considerably reduce the rate and extent of uptake. (Dissertation Abstr., 23: No. 5, Nov. 1962.)

7784 SEASONAL PATTERNS OF STABLE AND RADIOACTIVE IODINE IN THYROIDS OF NATIVE JACK RABBITS. W. C. Hanson (General Electric Co., Richland, Wash.). p.225-32 of "Transactions of the Twenty-Seventh North American Wildlife and Natural Resources Conference," Washington, D. C., Wildlife Management Institute, 1962. (HW-SA-2472)

Seasonal patterns of stable and radioactive iodine in thyroid glands of black-tailed jack rabbits, Lepus californicus wallawalla Merriam, from the Hanford Reservation in southeastern Washington were compared during 1956 to 1960. Amounts of stable iodine in thyroids varied more irregularly than did those of the radioactive isotope and were generally independent of environmental temperature, solar radiation, or precipitation. Maximum concentration of thyroidal I^{131} occurred during colder months; minimum concentrations occurred during early spring and late summer. Fallout radioiodine increased by ten times

the I^{131} burden in thyroid glands. An apparent downward trend in the affinity of thyroid glands for I^{131} was noted but not considered related to radiation damage because radiation dose rates and total dose to rabbit thyroid glands were several times less than those reported to produce thyroid damage in sheep. (auth)

Radiation Effects on Living Tissues

7785 (ARCRL-8) AGRICULTURAL RESEARCH COUNCIL RADIOBIOLOGICAL LABORATORY ANNUAL REPORT, 1961-62. (Gt. Brit. Agricultural Research Council. Radiobiological Lab., Wantage, Berks, England). Sept. 1962. 109p. (A/AC.82/G/L.806)

Results are presented from measurements of I^{131}, Sr^{89}, Sr^{90}, Cs^{137}, and Ba^{140} in foodstuffs in the United Kingdom during 1961 and 1962. Data are included from experimental studies of the mechanisms by which radioactive substances may be transferred into human diet. Emphasis was placed on transfer in soils, plants, and domestic animals. (C.H.)

7786 (BNL-5915) THE EFFECTS OF RADIATION ON TOTAL AND DNA SYNTHESIZING CELLS OF THE BONE MARROW AND BLOOD. A. Tsuya, I. Hayano, V. P. Bond, and T. M. Fliedner (Brookhaven National Lab., Upton, N. Y.). Jan. 9, 1962. Contract [AT(30-2)-Gen-16]. 24p.

Rats were exposed to 600 r and the cellularity, cytology, and ability to synthesize DNA as indicated by the use of H-3 thymidine and autoradiography were studied in the bone marrow in myelocytic precursors for the first 24 hours following exposure. A loss in the absolute number of early myelocytic precursors was noted over the first few hours following the exposure, although the total number of myelocytic forms in the bone marrow was not affected profoundly. With the lapse of time, the percentage of more mature myelocytic elements increased. The absolute number of labeled cells in all mitotable compartments decreased considerably more rapidly than did the total number of similar cells. A marked effect on DNA synthesizing ability was reflected in an early and marked decrease in grain counts of individual cells; however some recovery of the ability to synthesize DNA was noted. The reasons for a later increase in grain counts per cell are discussed. The number of labeled cells in the peripheral blood was affected markedly by radiation over the time period studied but initially also by the anesthetic. (auth)

7787 (BNL-5953) DISPOSITION OF RADIATION PRODUCTS AND ENERGY TRANSFER IN RADIOBIOLOGICAL PROCESSES. L. G. Augenstine (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract AT-30-2-GEN-16. 84p.

Reaction mechanisms involved in radiation effects in biological systems are discussed. In addition to radioinduced water radicals and the production of an ionization directly within a critical cellular component, there appears to be good evidence that strong exciton interactions should be important in the production of numerous radiation effects and also that resonance transfer involving only weak interactions can lead to quite specific photochemical changes with high yield. However, the small positive temperature coefficients associated with some radiation reactions indicate that the extent of exciton movement must not be the rate-determining factor. Of interest is the fact that the temperature coefficients for some of the radiation effects are of a magnitude normally associated with vibrational modes and are about the same as the activation energies measured for photoconduction in organic crystals. However, an assessment of the relative radiobiological importance of different transfer mechanisms surely must await a resolution of the current controversy over the types of excited intermediates and/or molecular rearrangements required for photogeneration of charge carriers. Such an assessment will also probably require a reappraisal of the nature of possible conduction bands, of electronic interactions and electromagnetic coupling, and of internal conversions in various macromolecular configurations. Some of the greatest success in research on the effects of ionizing radiation has been that of the radiation chemists in accounting for the observed effects in simple chemical systems as the sum of fairly straightforward reactions of radiation-produced water radicals. Unfortunately, in heterogeneous biological systems, the situation is more complex. In particular, it is not obvious that the relationship between yield and solute concentration, for a number of molecular systems, is entirely consistent with the simple model started above. That is, at high concentrations the yield is larger than that predicted on the basis that only a single or small group of water radicals is responsible for inactivation at all concentrations. Four alternative explanations are considered, including the possibility of energy or charge migration over distances of about 100 Å or the formation of secondary solute radicals. A determination of the feasibility of these various possibilities will depend upon much more detailed knowledge of the physical properties of radiation products and the electronic properties of liquid water. (auth)

7788 (BNL-6165) THE SOMATIC MUTATION THEORY OF AGING: ITS APPLICATION IN IRRADIATED AND NON-IRRADIATED LIVERS OF MICE. Cathryn Crowley and H. J. Curtis (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT(30-2)-Gen-16]. 12p.

The introduction of somatic mutations, represented by chromosome aberrations, as a result of radiation in young mice does not immediately produce the conditions of age. Rather they are part of an interacting system whose expression is checked in more youthful and vigorous stages by countering factors. In the non-pathological condition, some cells are lost as the prolonged result of deleterious somatic mutations present in the nuclei. The morphological integrity of chromosomes during several months of chronic gamma radiation is maintained. Severely damaged cells that have been exposed to fast neutrons can recover their ability to divide. The somatic mutation theory evidenced by the occurrence of chromosome aberrations with age is applicable in liver cells of control mice, and is regarded as a measure of the inherited rate of aging. (auth)

7789 (BNL-6595) INDIRECT EFFECT OF X-RADIATION ON BONE GROWTH IN RATS. R. A. Conard (Brookhaven National Lab., Upton, N. Y.). Dec. 21, 1962. Contract [AT-30-2-GEN-16]. 9p.

Effects of 200 to 600 r of x irradiation on tibial bone growth in groups of weanling male rats were studied by in vivo measurement of tibial bone growth in serial radiographs. By comparison of growth rates in shielded with unshielded legs, direct and indirect effects of radiation were demonstrated, both roughly dose dependent, but with the indirect effect being about twice that of the direct effect. Pair-feeding experiments showed that about 70% of the indirect effect was due to radiation-induced lowered food consumption. By partial-body shielding experiments, using pair-fed controls, it was shown that the abdomen may be the site of a non-nutritional abscopal effect. (auth)

7790 (HW-SA-2281) ARRESTED DEVELOPMENT IN X-RAYED LARVAE OF EPHESTIA KUEHNIELLA ZELLER

(LEPIDOPTERA: PHYCITINAE). H. E. Erdman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1961]. Contract AT(45-1)-1350. 8p.

Arrested development was induced by massive doses of x rays in Ephestia larvae and biological interpretations are proffered. Adverse influence upon neurosecretory interactions and/or upon the imaginal discs was demonstrated. No genetically explainable effects were noted between the sexes. The instantaneous lethal dose for larvae within 3 to 5 days of pupation is in excess of 50 kr. For most practical purposes death occurred at 15 kr because at this dose and those higher further development ceased. Increased incidence of disease, apathy toward food, lethargy, uncoordinated movements when probed, and wing abnormalities were other radiation induced effects noted. (auth)

7791 (TID-14624) EFFECTS OF X-RAYS ON THE SURVIVAL OF DROSOPHILA IMAGES. George A. Sacher (Argonne National Lab., Ill.). Oct. 1961. Contract [W-31-109-eng-38. 41p. (UAC-5705)

The response of Drosophila images to periodic x ray exposure consist of a reduction in variability of mean after survival between replicate samples, an increase in mean after survival over a range of daily dosages, and progressively reduced survival at higher daily dosages. The reduction of variability and improved survival are attributed to a reduction in the effectiveness of a deleterious environmental random variable. It cannot be determined whether this reduced effectiveness results from an inactivation of the environmental factor or from an increase in resistance induced in the flies by the radiation exposure. (auth)

7792 (TID-17425) EFFECT OF IRRADIATION AND CORTISOL ON THYMUS FRACTIONS. Ailene Herranen and Willa K. Brunkhorst (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). [1960] Contract AT(30-1)-2565. 11p.

Rabbits were exposed to 650 r of radiation or were injected with 10 mg cortisol for 3 days. Two methods were used for fractionation of thymus from control and treated animals. Method I was based on sequential extraction with water and saline. Nuclear and cytoplasmic fractions of lymphocytes were prepared by Method II. Minced tissue was stirred in sucrose-$CaCl_2$ and residual material homogenized in saline. Method I does not distinguish cytoplasmic and nuclear components. The weights of all fractions except Fraction A were lower in experimental animals when data is expressed as g/100 gms thymus. A large portion of Fraction A was found to be serum proteins as determined by the large increase in albumin in electrophoretic patterns. RNA was lower in most fractions from experimental animals. Electrophoretic analysis of the S_1 cytoplasmic fraction from lymphocytes obtained by method II, again shows a higher weight fraction of albumin in the extract from treated animals. Decreases in fractions attributed to nuclear material were noted in treated animals. Nuclear fractions were attributed largely to lymphocytes. Saline extracts and final residue show little change following irradiation, indicating these fractions are from radio resistant elements. Both fractions are more sensitive to hormone treatment. (auth)

7793 (TID-17426) EFFECT OF X-IRRADIATION ON AMINO ACID INCORPORATION INTO THYMUS CELL FRACTIONS. Ailene Herranen (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). [1961]. Contract AT(30-1)-2565. 9p.

Thymus was removed from rabbits 4, 6, and 18 hours after 650 r whole-body irradiation. Fractions were prepared from tissue of control and treated animals and in vitro incorporation of leucine-1-C^{14} measured into intact nuclei and cytoplasmic microsomal and ribosomal fractions. Labeling of sRNA was also measured. Inhibition of incorporation into nuclei was 35, 80 and 90 per cent respectively, 4, 6 and 18 hours after irradiation. Incorporation by the microsomal fraction showed 50 per cent inhibition at 4 and 6 hours and 85 per cent at 18 hours. No inhibition was found with the ribosomal fraction from thymus 4 hours after irradiation, but inhibition was detected in 6 and 18 hour post-irradiation preparations. At 4 and 6 hours after irradiation DNA, removable by deoxycholate treatment, was found in the microsomal fraction. DNA was also found in the cytoplasmic 5.1P and sRNA extracted from this fraction. When a colorimetric method is used for RNA analysis in the assay procedure, no inhibition of labeling of sRNA is observed. (auth)

7794 (TID-17427) A STUDY OF THE EFFECT OF IONIZING RADIATION ON LYMPHATIC TISSUE. Progress Report, May 1, 1960–November 15, 1962. Ailene Herranen (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). Contract [AT(30-1)-1934]. 8p.

Extracts obtained by two fractionation methods from normal thymus and involuted thymus were compared to test if the fractions obtained were from the radiosensitive lymphocytic cells or from the radioresistant reticular cells. Method I, based on sequential extraction with water and saline, did not distinguish lymphocytic and reticular cell components. Method II, based on initial slow stirring with sucrose-$CaCl_2$, yielded cytoplasmic and nuclear fractions predominately from lymphocytes. Saline extracts of tissue remaining after sucrose-$CaCl_2$ extraction and the final residue showed little change following irradiation indicating these fractions originate from radioresistant reticular cells. The effect of 650 r whole-body x irradiation on the ability of rabbit thymus nuclei and cytoplasmic fractions to incorporate leucine-1-C^{14} in vitro was measured at 4, 6, and 18 hours after irradiation. The incorporation of leucine by intact nuclei is inhibited 35, 80, and 90% respectively 4, 6, and 18 hours after irradiation. Incorporation of the microsomal fraction shows 50% inhibition at 4 and 6 hours and 85% at 18 hours after treatment. No inhibition of incorporation is found with the ribosomal fraction from tissue 4 hours after irradiation, but inhibition is found at 6 and 18 hours after treatment. At 4 and 6 hours after irradiation, DNA, removable by deoxycholate treatment, was found in the microsomal fraction. DNA is also found in the cytoplasmic 5.1P and the sRNA extracted from this fraction. When a colorimetric method is used for RNA analysis in the assay procedure, no inhibition of labeling of sRNA is observed. The amount of DNA in the fractions is greatly reduced 18 hours after treatment. (auth)

7795 (TID-17446) MECHANISMS OF ACTION OF X-RADIATION ON PLANTS. Richard M. Klein (New York Botanical Garden, New York). [1962]. Contract AT(30-1)-2587. 8p.

A red light was shown to induce a dose reduction effect on x-ray induced suppression of leaf disk expansion in etiolated bean leaf and conidia of Neurospora. A similar dose reduction was found following treatment of leaf disks with hydrogen peroxide or tertiary butyl hydroperoxide. Possible reaction mechanisms involved in the action of far red radiation and oxidizing agents within a cell are discussed. (C.H.)

7796 (TID-17451) EFFECT OF SINGLE AND DIVIDED DOSES OF X-IRRADIATION UPON LONGEVITY

IN RATS. B. G. Lamson, M. S. Billings, J. J. Gambino, and L. R. Bennett (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). [Oct. 1, 1962]. Contracts AT(04-1)-Gen-12 and AF41(657)-275. 22p.

Longevity in Long Evans-Wistar f_1 hybrid female rats was observed following 0, 120, 240, and 480 r total-body x irradiation administered in either single or divided exposures. Divided exposures consisted of either 3 or 6 equal fractions spaced at 3.5, 7, or 14 day intervals. Life span was significantly shortened by irradiation when the total dose was expressed on either a linear or logarithmic scale. The greater the dose the larger the life shortening, even 120 r shortening life by 13 per cent. Increase of numbers of dose fractions from 3 to 6 significantly improved longevity. The protective effect of dose fractionation is dose dependent, being demonstrated at 480 and 240 r but not at 120 r. Spacing of dose fractions at 3.5, 7, or 14 day intervals did not influence longevity. Estimated regression coefficients indicate that fractionation of a dose in the 1, 3, 6 fraction range offers approximately 30 to 46% of the protection gained by reducing the total radiation dose by one half in the 0, 120, 240, 480, r dose range. (auth)

7797 (TID-17502) RADIO-ECOLOGY OF SMALL VERTEBRATE SPECIES UNDER NATURAL ENVIRONMENTS. Progress Report, January 1–November 1, 1962. C. A. Tryon, Jr. (Pittsburgh. Univ.). Contract AT(30-1)-2579. 26p.

Two species of rodents, the northern pocket gopher, Thomomys talpoides, and the eastern chipmunk, Tamias striatus, were selected as suitable for experimental treatment of natural populations with gamma radiation. Parameters of individual and population characteristics for these species were established along gradients of environmental diversity and population density. Morphometry, endocrine gland size, elimination rate for radioisotopes, and fecundity were the parameters measured for populations. Soil, vegetation, food, and climate were the environmental factors measured in relation to these individual and population parameters. Populations were live trapped, tagged, and returned to their homes for experimental work with gamma radiation. Studies on pocket gophers were carried out in Wyoming and those on chipmunks were carried out in Pennsylvania. (C.H.)

7798 (TID-17544) ENERGETICS TRANSFER IN THE PHOTODYNAMIC REACTION. Annual Progress Report, November 1962. Leonida Santamaria (Milan. Università. Istituto di Patologia Vegetale). Contract AT(30-1)-2734. 73p.

Study on steroid hormone action on isolated mitochondria in the presence of light led to the conclusion that 10 of these important compounds, so far tested, do not react with mitochondrial structures. The oxygen-dependence of the photoresponse of calf retinas suggested that it could be of great interest to investigate the behavior of retina metabolism following x irradiation. This showed that visible light produces impairment of the respiratory enzyme chain whereas it affects the glycolytic system to a very small extent. X rays bring about, on the other hand, striking opposite effects. These data became very helpful when associated with those of the incorporation of leucine C^{14}. In fact, we observed that the energy requirement for aminoacid incorporation comes mainly, if not completely, from glycolysis. This is important since in differentiated retinas there are both anaerobic and aerobic glycolysis without Crabtree effect. The search for the selection of a simple photodynamic model inspired three investigations on blood-serum and on fibrinogen employing paper and starch-gel electrophoresis and thrombelastography. The results indicated that fibrinogen is an adequate substrate in order to evaluate by starch-gel electrophoresis and thrombelastography modifications related both to change of fine molecular characteristics and to the decay of a biological activity. (auth)

7799 (TID-17579) RADIATION INDUCED VIABILITY MUTATIONS IN THE HONEY BEE. Progress Report. William R. Lee (New Hampshire. Univ., Durham). 1962. Contract AT(30-1)-2315. 7p.

Results of experiments on partial-body irradiation of queen honey bees show that irradiating the segments III through V of the abdomen produces the same lethal effect as whole-body irradiation, whereas irradiating any other body region does not produce a significant amount of radiation deaths during the following three weeks. Apparently, irradiation of segments III through V of the abdomen prevents the replacement by cell division of the digestive cells lining the ventriculus, and the queen then starves for lack of proper digestion. It is concluded that variations in the normal rate of cell division in the ventriculus of various insects and in the length of time different species can go without food can explain the great variation in resistance of adult insects to irradiation. (C.H.)

7800 (TID-17580) COMPARATIVE STUDIES OF THE EFFECTS OF X-RADIATION ON PROTOZOA AND MAMMALS. Progress Report, December 1, 1961–November 1, 1962. Jay S. Roth (Connecticut. Univ., Storrs). Contract AT(30-1)-2737. 48p.

The distribution of thymidylate and uridylate phosphatases, acid desoxyribonuclease, and β-galactosidase was determined in subcellular fractions of spleen from irradiated and control rats. Fundamental studies on desoxynucleotide metabolism in rat liver were continued. A hypothesis is presented concerning patterns of desoxyribonucleotide metabolism in tumors in relation to rate of cell proliferation. Experiments were continued on the effects of catalase inhibition on normal and irradiated Tetrahymena. Preliminary data are presented. (C.H.)

7801 (TID-17641) EFFECTS OF RADIATION UPON REAGGREGATION OF DISSOCIATED EMBRYONAL CELLS. Progress Report. R. M. Roppel (Battelle Memorial Inst., Columbus, Ohio). Nov. 28, 1962. Contract AT(30-1)-2961. 40p.

The radiation sensitivity of the ability of embryonal cells to aggregate into histotypic cell masses varies greatly according to the tissue from which the cells were derived. For example, the tendency of 7-day chicken neural retinal cells to coalesce into characteristic cell masses is much impaired by gamma ray doses of only 500 r. By contrast, the ability of 7-day chicken liver cells to form type-specific structures is apparently unimpaired by doses as great as 40,000 r, but is damaged by doses of 60,000 r and greater. In the case of cells derived from both these tissues, the earliest apparent effect with increasing radiation doses is a weakening of the tendency toward formation of coherent cell masses, as evidenced by the formation of smaller aggregates. At doses only slightly greater than sufficient to weaken bonding, there occurs a decrease in the frequency with which characteristic multicellular structures are seen in the aggregates. A possible interpretation of these observations is that the impairment of mutual adhesion properties of the cells results in a failure of their communicative properties, i.e., of their abilities to interchange the stimuli required for concerted action. Neural retinal cells, when

aggregated together with liver cells from a mixed suspension, predominate in the determination of properties of the mixed aggregates. This dominance is much weakened when the retinal cells have been subjected to a radiation dose as small as 500 r. Irradiated retinal cells in such aggregates also demonstrate some loss of specificity of combination; rather than occurring in domains consisting entirely of neural retinal tissue, they are found intermixed with liver cells. Electron microscopic evidence suggests that tissues formed by reaggregation of embryonal cells are syncytial in character for at least 48 hours after the onset of reaggregation. In tissues formed by cells that have been irradiated to the extent that aggregation and differentiation are impaired, cell membranes are present and relatively intact. These observations, if confirmed by future studies upon a greater variety of tissues, would imply that the breaking down of cell membranes and establishment of a syncytial condition is necessary for redifferentiation to occur. (auth)

7802 (TID-17650) EFFECT OF X-IRRADIATION ON THE CELLULAR AND HUMORAL RESPONSES TO ANTIGEN. Robert S. Speirs (New York. State Univ., New York. Downstate Medical Center). [1962]. Contract [AT(30-1)-2916]. 36p.

Mice were immunized by 6 subcutaneous injections of tetanus toxoid before exposure to 500 r x radiation. At various times after irradiation the animals were challenged with intraperitoneal injections of tetanus toxoid and serum antibody titers were determined. Results indicate that the time of irradiation in relation to antigen injection greatly influences the cellular response as well as antibody production. High radiation doses prior to antigen injection reduce the number of cells capable of responding and also inhibit the production of antibody. As the animals recovered from the effects of irradiation the production of antibody appeared to reflect the capacity of the eosinophils to respond. It was concluded that eosinophils play an intermediate role in the cellular events that lead to the production of antibody. (C.H.)

7803 (TID-17695) ELECTRON MICROSCOPIC STUDIES ON THE GIANT AMOEBA, PELOMYXA ILLINOSENSIS (thesis). Robert Earle Waterman (Argonne National Lab., Ill.). June 1962. Contract [W-31-109-eng-38]. 80p. (UAC-6938)

Results are reported from electron microscopic studies of pinocytosis and radiation damage in the giant amoeba, Pelomyxa illinoisensis. Radioinduced changes in nucleoli are reported. (C.H.)

7804 (USNRDL-TR-595) LATE EFFECTS OF FRACTIONATED X RADIATION IN MICE. FAILURE TO PREVENT NON-THYMIC LYMPHOMAS BY THIGH-SHIELDING. L. J. Cole and P. C. Nowell (Naval Radiological Defense Lab., San Francisco). Nov. 4, 1962. 18p.

Groups of female LAF_1 mice were exposed to an x-ray dose of 260 rads given in a single dose (at 11 weeks or 14 months of age) or in 52 weekly doses of 5 rads each (started at 11 weeks of age). A group of the latter animals had one thigh shielded during the irradiation procedure. The incidence of malignant lymphoma, of the generalized nonthymic type, was increased in both of the groups receiving fractionated doses of radiation; thigh-shielding did not inhibit leukemogenesis under these conditions. This finding suggests that the mechanisms of radiation induction of thymic and nonthymic lymphomas in mice may differ, since in the former case, shielding of hematopoietic cells reduces lymphoma incidence. Median life span did not differ significantly among the 3 groups of mice irradiated at 11 weeks of age. The median life span for the mice receiving a single dose of 260 rad at 14 months of age was 5 months longer than that of the group receiving a single dose of 260 rad at 11 weeks of age. (auth)

7805 (USNRDL-TR-597) SPLEEN COLONY FORMATION AND HEMOPOIETIC RESTORATION IN LETHALLY X-IRRADIATED MICE AFTER INJECTION OF ISOGENIC PERITONEAL CELLS. L. J. Cole (Naval Radiological Defense Lab., San Francisco). Nov. 13, 1962. 15p.

The capacity of intravenously injected cells from peritoneal fluid, peripheral blood, lymph nodes, thymus and bone marrow of mice to restore hematopoiesis in lethally x-irradiated (880 rad) isogenic recipients, was investigated. Thirty-day survival, and visible colony formation in the spleen were employed as the criteria. Administration of 6×10^6 or 11×10^6 peritoneal cells, and 6.4×10^6 or 15×10^6 peripheral leucocytes afforded protection against mortality, and elicited colonies in the spleen; comparable effects were observed after injection of 1.1×10^5 marrow cells. The injection of 34×10^6 adult lymph node cells or of 9×10^6 thymus cells from newborn mice had no effect on mortality, nor did they elicit spleen colony formation. A correlation appears to exist between the capacity of isogenic cells to restore hemopoiesis in lethally irradiated mice and their ability to elicit visible colony formation in the spleen. The evidence suggests that normal peritoneal cell populations and peripheral blood leukocytes contain hemopoietic stem-cell elements, with a frequency 30 to 50 times lower than among bone marrow cells. No evidence was adduced to support the concept that normal lymphoid tissue lymphocytes give rise to hemopoietic cell lines. (auth)

7806 INFLUENCE OF γ-IRRADIATION ON LIVER REGENERATION IN NORMAL AND STARVED RATS. Celina Janion and D. Shugar (Inst. of Biochemistry and Biophysics, Polish Academy of Sciences, Warsaw). Acta Biochim. Polon. (English Transl.), 9: 271-80(1962).

The liver region of rats was submitted to a radiation dose of 1430 r and, following hepatectomy, a study was made of the effect of irradiation during early stages of regeneration on cellular division and, following 72 hr, on the overall values of liver weight and contents of DNA, RNA, and protein. Irradiation was found to retard the appearance of mitosis in regenerating tissue and to result in a decreased rate of regeneration of DNA. Rats were starved for 24 hr, then irradiated as above and operated, following which they were normally fed. Under these conditions liver regeneration was more rapid; furthermore there was more pronounced retardation of the regeneration of various constituents under the influence of irradiation, which appeared to be linked with the greater variations in body weight between non-irradiated and irradiated animals. If only the head, or the limbs, were irradiated, there resulted a temporary retardation of mitosis in the operated liver, but this was of short duration and, following the period of inhibition, was succeeded by a period of intense division. (auth)

7807 DEUTERON AND γ-IRRADIATION OF DRIED PREPARATIONS OF LYSOZYME AND RIBONUCLEASE. Zofia Tramer and D. Shugar (Inst. of Biochemistry and Biophysics, Polish Academy of Sciences, Warsaw). Acta Biochim. Polon. (English Transl.), 9: 281-93(1962).

Lysozyme and ribonuclease, two enzymes with similar structure and almost identical molecular weights, were irradiated in the dry state with deuterons and γ-rays. Individual irradiation of each enzyme either with deuterons or γ-rays, under identical conditions, shows that their ac-

tive cross sections are almost identical; and from the deuteron irradiations their molecular weights are calculated as 11,000, so that their active cross sections are about 20% less than those calculated directly from the accepted molecular weights. However, if both enzymes are irradiated together, in the form of a mixture, anomalies make their appearance in the form of a mutual protection of each enzyme by the other. This effect is particularly pronounced with γ-irradiation and under conditions where some air and moisture are present; but it is also present, although to a smaller extent, with deuteron irradiation under conditions of high vacuum. In addition there is some evidence for a dose-rate effect with γ-irradiation in the presence of air. The results are discussed in relation to the general validity of application of the target theory to absolute calculations of active cross sections and molecular weights. The data are also compared and discussed in relation to those of other observers. (auth)

7808 CHANGES IN PERIPHERAL BLOOD AFTER A SINGLE EXPOSURE TO RADIATION COMBINED WITH ACUTE BLOOD LOSS. D. G. Zografov. Acta Med. Acad. Sci. Hung., 18: No. 1, 27-33(1962).

Eighty male guinea pigs were divided into 4 groups: 10 were bled from the jugular vein, causing a loss of 25% of the total blood; 30 were exposed to x rays (300 r) at a distance of 50 cm; 20 were irradiated 30 min after the bleeding; and 20 were irradiated on the 3rd day after the bleeding, when the stimulating effect of the blood loss upon hematopoiesis was at its peak. The red cell, reticulocyte, neutrophile, lymphocyte, and platelet counts were checked daily up to the 5th day and then every second day until the 30th day. Whereas in the 1st group the red cell count was gradually restored to the original level, it showed a steep fall in animals irradiated after the hemorrhage, a fall which was less marked in the 4th group. Regeneration was slowest in the 3rd group. The reticulocytes disappeared completely in the 2nd group (radiation only), but persisted, even in the aplastic period, in the 3rd and 4th groups (hemorrhage and radiation). Preliminary blood loss exerts, therefore, a protective effect against radiation as in the hyperplastic bone marrow a greater number of erythroblasts appears to survive. The preliminary stimulation of hematopoiesis seemed to counteract the usual suppression of blood cell proliferation by radiation. The compensation was, however, not complete, as shown by a further fall in the red cell count after radiation. The fact that the protective effect was more marked in the 4th group supports the view that the effect is based upon the stimulation of the hematopoietic apparatus where stimulation is known to reach its peak on the 3rd day. The restoration of reticulocytes, neutrophiles, and platelets was more rapid after combined blood loss and irradiation than after irradiation only. This also applied to later periods when the primary stimulation caused by the hemorrhage must have subsided. Hence the existence of an indirect stimulating mechanism consisting, for example, of the formation and accumulation of hematopoietic substances in the blood following acute hemorrhage is postulated. (P.C.H.)

7809 ANTIRADIATION EFFECT OF PHYSICAL EXERCISE. L. Markiewicz. Acta Physiol. Polon., 13: 467-76 (1962).

Experiments were conducted with four groups of rats: I—untrained, control; II—trained, control; III—untrained, irradiated; IV—trained, irradiated. Groups III and IV were subjected to whole-body x irradiation with a single dose of 700 r. Group III animals developed acute radiation sickness 3 to 4 days after exposure. The glucose content of their blood increased, reaching a maximum (42% above that of the controls) 24 hrs after exposure, then decreased to 18% below that of the controls 14 days after irradiation. The lactic acid content increased gradually to 302% above the level of the controls 14 days after irradiation. The contents of pyruvic acid and cholesterol did not show any appreciable changes. Group IV rats, subjected to 30-day training on a mechanical treadmill, showed less pronounced changes in their blood components. The content of lactic acid increased to 26%, of phospholipids to 7%, and of pyruvic acid to 23% above that of Group II 24 hrs after irradiation. Fourteen days after exposure the lactic acid content was 45% above that of the controls. Since the changes induced by ionizing irradiation in the contents of glucose, pyruvic acid, lactic acid, cholesterol, and phospholipids in the blood of rats subjected to systematic physical exercise were less pronounced than in untrained rats, it may be assumed that physical exercise has a protective antiradiation effect. (OTS)

7810 HEAVY PARTICLE THERAPY IN ACROMEGALY. J. H. Lawrence, C. A. Tobias, J. L. Born, Fr. Sangalli, R. A. Carlson, and J. H. Linfoot (Univ. of California, Berkeley). Acta Radiol., 58: 337-47(Oct. 1962). (In English)

Seventeen acromegalic and two chromophobe adenoma patients were treated with pituitary irradiation using 900 Mev alpha particles. Following therapy three patients with concurrent diagnoses of diabetes mellitus no longer required insulin. Male acromegalic patients had a relatively high level of urinary estrogens prior to therapy which subsequently decreased. Levels of serum phosphorus, serum growth hormone, urinary steroids and gonadotropins decreased. Eighteen patients are still living; one patient died of coronary occlusion three and a half years after treatment. Since the doses which can be delivered to the pituitary gland are considerably greater than those delivered by conventional roentgen or gamma irradiation, better control and further life extension in acromegaly is expected. (auth)

7811 IMPROVED PROTECTION IN THE INTRAUTERINE RADIUM PACKING METHOD. I. Ragnhult, B. Rosengren, and J. Borggren (Univ. of Goteborg). Acta Radiol., 58: 348-52(Oct. 1962). (In English)

Changes in routine, the use of separate inserters for each radium applicator, and a specially designed sterilization cart, have made it possible considerably to reduce the radiation hazards attending the packing of the body of the uterus. (auth)

7812 GENETIC EFFECTS OF THE ATOMIC BOMBS. J. V. Neel and W. J. Schull (Univ. of Michigan, Ann Arbor). Acta Radiol., 58: 385-98(Oct. 1962). (In English)

Methods are outlined that were used in the statistical analysis of data resulting from genetic studies on the populations of Hiroshima and Nagasaki for the existence of a correlation between the radiation history of parents and certain indicators of possible genetic damage to their children. Problems in obtaining accurate information on human populations are discussed. (C.H.)

7813 THE EFFECTS OF IONIZING RADIATION ON THE EAR. Steven Borsanyi, Cyrus L. Blanchard, and Bert Thorne (Univ. of Maryland, Baltimore). Ann. Otol. Rhinol. Laryngol., 70: 255-62(Mar. 1961).

To determine how high-dose tumor radiotherapy affects the fine structure of the ear, 14 patients receiving 4000 to 6000 r Co^{60} radiation at the region of the cochlea were studied. Radiation affected individuals selectively, causing a small shift in hearing threshold in some but not in others. The shift appeared to be primarily due to the de-

velopment of a radiation otitis media. No changes were observed in some of the ears examined. The appearance of perceptive hearing loss and temporary recruitment is thought to be related to a transient vasculitis in the inner ear. The disturbed function of the cochlea is probably the result of an altered metabolism of the hair cells or an increased endo- or perilymphatic pressure due to the transient vasculitis. It is concluded that ionizing radiation in the dose used for head and neck tumors does not cause microscopically detectable changes during the course of treatment in the cochlea or labyrinth. The late effects of radiation result from changes in collagen, blood vessels, and bone and are a separate entity. Necrosis and breakdown of the skin of the external ear canal with or without secondary infection was seen less frequently during or following Co^{60} treatment compared with conventional x-ray therapy. (H.H.D.)

7814 A DERMAL LESION FROM IMPLANTED PLUTONIUM. C. C. Lushbaugh and J. Langham (Los Alamos Scientific Lab., N. Mex.). Arch. Dermatology, 86: 461-4 (Oct. 1962). (LADC-5302)

Histologic and autoradiographic examination of a piece of palmar human skin said to have been contaminated by a penetrating piece of plutonium revealed intense α-track concentration in a minute focus of subacute and chronic radiodermatitis. Although the penetration of the α-particles was minimal, the severe local effects seemed to indicate that a massive dose of α-radiation had been delivered to the area in the 4 years the contamination had been present. (auth)

7815 FATAL HYPERPLASTIC LESION IN NEUTRON-EXPOSED MICE. C. C. Lushbaugh (Los Alamos Scientific Lab., N. Mex.). Arch. Pathol., 74: 297-303(Oct. 1962). (LADC-5303)

Autopsies upon mice dying 16 months after exposure to fast neutrons produced by atomic bombs being tested in the field revealed that over half of the animals died from a hyperplastic gastric inflammatory disease that caused gastrointestinal obstruction. In some instances, this lesion appeared grossly and microscopically malignant. Subsequent study of the 150 autopsies failed to disclose any undoubtable adenocarcinomas, but 8 primary gastric lymphosarcomas were found along with 18 fibroadenomas. The large number of seemingly related variable gastric lesions was used to synthesize a pathogenesis for this apparent late postirradiation effect of fast neutron exposure. It was concluded that the incidence and severity of this disease in irradiated mice justified establishing gastric death as another fatal late postirradiation syndrome. (auth)

7816 INVESTIGATION OF THE INFLUENCE OF ION DOSE RATES ON THE RADIATION EFFECTS ON THE ISCHIADICUS OF FROGS. W. Kroebel and K. Vanselow (Universität Kiel). Atomkernenergie, 7: 464-70(Dec. 1962). (In German)

A method is described with which the influence of radioactive rays on the nerve can immediately be registered quantitatively. With this measuring method, the reaction of the nervus ischiadicus of the frog during irradiation with x rays was investigated. The peak potential of the nerve bundle served as the criterion. In order to be more sensitive during measurement, a compensation procedure was adopted. Potential changes of the nerve signal in proportion to the dosage power were investigated at stimulation frequencies of 10 and 74 cycles. The spot which was stimulated was irradiated. The measurement results showed a different reaction at a stimulation frequency of 10 cycles than at 74 cycles. The result is discussed and compared to works on other cell types. It is shown that on the basis of this measuring method, the threshold value change or the sensitivity change of the nerve was measured, and, thus, only a reaction of this nerve quality was investigated. (auth)

7817 EFFECTS OF FIELD-STRENGTH, BEAM-ENERGY AND INTERMITTENT IRRADIATION ON THE LETHALITY OF GAMMA RADIATION FOR SPORES OF CLOSTRIDIUM BOTULINUM. J. T. Graikoski and L. L. Kempe (Univ. of Michigan, Ann Arbor). Atompraxis, 8: 467-70(Dec. 1962). (In English)

The influence of field-strength, radiation energy, and interruption of irradiation on the lethality of gamma rays for Clostridium botulinum 62 A and 213 B spores were evaluated. Three Co^{60} and one Cs^{137} radiation sources were used. Variation in field strengths from 0.002 to 2.20 megarad per hour were utilized in the Co^{60} sources. None of the variables was found to significantly affect the lethality of gamma rays for Clostridium botulinum spores. Therefore, insofar as the sporocidal effect of gamma radiations are concerned, the results show that data obtained on moderately weak radiation sources can be extrapolated for design purposes to field strengths of at least 2 to 3 megarad per hour; that interruption of irradiation for short intervals has little effect; and that Cs^{137} should be essentially as useful as Co^{60} sources for food sterilization purposes. (auth)

7818 RADIATION SENSITIVITY IN ANIMALS WITH A LOW LEVEL OF INTESTINAL FLORA. G. Schabinski and W. Ahlendorf (Friedrich-Schiller-Universität, Jena, Ger.). Atompraxis, 8: 473-7(Dec. 1962). (In German)

The influence of radiation on immunity in connection with intestinal flora is reviewed. The well-known effect of broad-spectrum antibiotic therapy following radiation insult serves as a protection against radiation. This effect was confirmed by animal experiments. After irradiation mice were given tetrecycline and talisulfazole. Lengthened survival times revealed the inhibition of postirradiative enterogenous bacteriemia. On the other hand, a low level of intestinal flora before irradiation shortened the survival time of irradiated mice. This may be interpreted as evidence that intestinal flora are necessary for an efficient defense system in the organism. Properdin measurements in 32 tumor patients before irradiation showed a low mean of 3.8 standard units/ml. After the beginning of irradiation there was a rise in the properdin level of most of the patients; during the third week of irradiation the level declined to a mean of 1.8 standard units/ml. Properdin tests during a period of up to six weeks after irradiation revealed only a slow rise in the properdin level. (auth)

7819 IRRADIATION OF MICE WITH FRACTIONATED DOSAGES OF X-RAYS. THE EFFECTS ON ORGAN WEIGHTS AND THE HEMATOLOGICAL PICTURE. W. S. Moos, J. W. Yusken, J. B. Fuller, J. C. Plagge, and R. A. Harvey (Univ. of Illinois, Chicago). Atompraxis, 8: 477-81 (Dec. 1962). (In German)

Groups of mice were irradiated with 4, 16, and 32 r/day over a period of 30 weeks. Weight changes of major organs and variations in the blood picture were tested. Only testes showed significant weight losses at an early stage. The red blood cell count remained constant. Other blood changes were observed only in the 32 r/day animal groups. (auth)

7820 A QUANTITATIVE STUDY OF BONE MARROW GRAFTING: IMPLICATIONS FOR HUMAN BONE MARROW INFUSION. D. E. Pegg (Westminster Hospital and Medical School, London). Brit. J. Cancer, 16: 400-16(Sept. 1962).

Radiation survival curve data and total bone marrow

cellularity measurements in experimental animals and man are reviewed. On the basis of total bone marrow cellularity and the minimum effective marrow infusion in animal experiments it is concluded that a 70 kg man would require 0.7 to 5.2×10^9 autologous marrow cells or 9 to 13×10^9 homologous marrow cells after lethal whole-body irradiation. Bone marrow protection is far less effective after lethal doses of radiomimetic chemotherapeutic agents. When the numbers of marrow cells calculated to survive various doses of whole-body irradiation are calculated and compared with the amount of marrow infused in successful isologous marrow grafting experiments, it is found that numerical comparison gives unacceptable results; reasons for this anomaly are suggested which avoid the proposition that marrow cells have an intrinsic radiosensitivity different from that of other somatic cells. The practical care of the patient who has received large doses of whole-body irradiation or radiomimetic chemotherapy is considered. The potency of autologous marrow infusion and the dangers of homologous marrow infusion are emphasized and the place of antibiotics, platelet, and whole blood treatment is discussed. (auth)

7821 THE CLINICAL APPLICATION OF BONE MARROW GRAFTING. D. E. Pegg, J. G. Humble, and K. A. Newton (Westminster Hospital and Medical School, London). Brit. J. Cancer, 16: 417-35(Sept. 1962).

Eight patients were treated with total thoracic irradiation of 2500 to 3058 r and subsequently received intravenous infusions of stored autologous bone marrow. Sternal bone marrow recovery was somewhat increased by this procedure. One patient receiving trunk irradiation to a dose of 560 r recovered rapidly after autologous marrow infusion. One patient receiving total-body irradiation to a center dose of 300 to 350 r showed rapid recovery after autologous marrow infusion. In a study of nineteen patients treated with chemotherapeutic agents it was found that in those who had received large doses of mustine hydrochloride and mannomustine dihydrochloride, the rapidity of hematological recovery was increased, and a less marked benefit was noted in patients treated with N-deacetylthiocolchicine and triethyleneglycol diglycidyl ether. In those cases treated with cyclophosphamide and phenylalanine mustard, no benefit from autologous marrow infusion was detected with the doses employed. Twenty-three patients received homologous marrow infusions. Twelve showed subsequent improvement of the blood picture, but this was not due to successful bone marrow homografts. Successful, albeit transient, grafting occurred in one case. A second patient probably had a take, but she died before proof could be obtained. (auth)

7822 STUDIES OF POTENTIAL RADIOSENSITIZING AGENTS. THE EFFECT OF 2-METHYL-1:4-NAPHTHOHYDROQUINONE DIPHOSPHATE (SYNKAVIT) ON THE LEVEL OF ADENOSINE TRIPHOSPHATE IN MOUSE ASCITES TUMOUR. Barbara Chipperfield and D. H. Marrian (Cambridge Univ., Eng.). Brit. J. Cancer, 16: 460-5(Sept. 1962).

The radiosensitizing agent, Synkavit, reduces the ATP content of Ehrlich mouse ascites tumour cells in vivo at dose levels of about 1μ Mole/gram and in vitro at concentrations between 3×10^{-2} and 3×10^{-6} molar. The higher concentration of the substance reduced the respiration, while the low concentration caused a small stimulation in vitro. (auth)

7823 EFFECTS OF X-RADIATION AND OF METABOLIC INHIBITORS ON RAT THYMOCYTES IN VITRO. D. K. Myers, Donna E. DeWolfe, and Kimiko Araki (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Biochem. Physiol., 40: 1535-52(Nov. 1962).

The survival of x irradiated thymocytes in vitro was studied after incubation for various periods of time and at different pH values as well as at different temperatures. Death at 25°C following exposure to high doses of x radiation may be due to the liberation of destructive enzymes. The effects of high doses could be largely prevented by addition of nicotinamide after irradiation. The cause of cell death at 37°C following exposure to low doses of x radiation is still uncertain. Some metabolic inhibitors also showed a considerable difference in their toxicity to thymocytes at 37°C and at 25°C. Dinitrophenol, for example, was highly toxic at 37°C but almost ineffective in killing cells at 25°C, even though it produced similar decreases in ATP levels at both temperatures. The marked difference in survival of irradiated thymocytes at 37°C and at 25°C could therefore be explained if low doses of x radiation interfered with the normal cell metabolism. However, low doses of radiation, unlike dinitrophenol, did not produce any immediate decrease either in ATP levels or in oxygen consumption of thymocyte suspensions. (auth)

7824 X-IRRADIATION OF RIBOSE AND DEOXYRIBOSE DERIVATIVES. D. K. Myers (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Biochem. Physiol., 40: 1553-65(Nov. 1962).

During x irradiation of ribosides and deoxyribosides in dilute aqueous solution, purine and sugar moieties were destroyed at approximately the same rate. Pyrimidine moieties, on the other hand, were destroyed more rapidly, resulting in a fairly rapid liberation of free sugar during irradiation of pyrimidine ribosides or deoxyribosides. No marked differences in the rates of destruction of ribose and deoxyribose derivatives were observed in these experiments. Similar reactions were observed during irradiation of blood samples. However, acid-soluble ribonucleotides in the blood proved to be much more sensitive than the nucleic acids or proteins to destruction by x radiation. The significance of these findings is discussed with relation to the damage produced in cells by x irradiation. (auth)

7825 FACTORS INFLUENCING X-RAY TOLERANCE OF HAPLOPAPPUS GRACILIS SEEDS. Om P. Kamra and Saroja K. Kamra (Univ. of Manitoba, Winnipeg, Can.). Can. J. Genet. Cytol., 4: 255-62(Sept. 1962).

Seeds of Haplopappus gracilis were exposed to acute doses of x rays ranging from 4,000 r to 40,000 r to study the factors affecting the tolerance of this species. Criteria used in determining the radiation tolerance included growth inhibition measured by seed germination and survival of M_1 plants to maturity, and the recovery of reciprocal translocations in mature M_1 plants. The results obtained indicate that H. gracilis is able to withstand large doses of x rays without much apparent injury. Various nuclear characteristics and their relation to radiation tolerance of H. gracilis are discussed. H. gracilis possessed many of the nuclear properties that are usually associated with high susceptibility to radiations in other species. A study of seed oil content and fatty acid composition revealed 15% oil rich in the unsaturated fatty acids, linoleic, oleic and palmitoleic acids. The interpretation of these factors in relation to radioresistance is discussed. (auth)

7826 IRRADIATION-INDUCED CHROMOSOME ABERRATIONS IN NORMAL HUMAN LEUKOCYTES IN CULTURE. A. G. Bell and D. G. Baker (Research Inst. of the Hospital for Sick Children, Toronto and Banting and Best Dept. of Medical Research, Toronto). Can. J. Genet. Cytol., 4: 340-51(Sept. 1962).

An investigation of irradiation-induced chromosome aberrations in human leukocytes in short-term culture is described. In the production of one-hit aberrations there appeared to be a linear response to dose, but no dose-rate effect. The data were compatible with either a linear or a possible power-function relationship between dose and aberration frequency in the production of two-hit aberrations. The small sample size was considered to be the most probable explanation for this lack of discrimination. A definite dose-rate response was observed in the production of two-hit aberrations, the larger number being produced at the higher dose-rate. It is difficult to compare induction rates as derived from different laboratories, owing possibly to different methods of scoring, and also to attempt to derive "break-rates" by combining one-hit and two-hit aberration data. Because of a definite dose-rate effect on the production of two-hit aberrations, and also because these are expected to occur as a power-function of the dose, induction rates might more properly be calculated for each type of aberration separately. These studies indicate that irradiation-induced polyploidy follows from the initial induction of endoreduplication. The chromosome pairs of the endoreduplicated cells appear to fall apart at the first mitotic division following diplochromosome induction, to result in tetraploid daughter cells. Short-term cultures of human leukocytes provide a satisfactory system in which to examine irradiation effects. (auth)

7827 RADIOBIOLOGICAL EXPERIMENTS IN THE HIBERNATING DORMOUSE. Hans A. Kuenkel (Universitäts-Frauenklinik Hamburg-Eppendorf, Ger.). Chemotherapia, 3: 200-24(1961). (In German)

The effect of x radiation on dormice was investigated in both the hibernating and waking state. In waking animals given 700-r 200-kv irradiation, the 30-day mortality was ~37%. However, after irradiation of hibernating animals with the same dose, none of the animals died in the subsequent 21-day period of continuous hibernation. No outward evidence of radiation effects was noted in the hibernating dormouse, but if they were awakened by warming to 38°, the effects of radiation appeared. When awakened 21 days after irradiation, the mortality rate 30 days later (51 days after irradiation) reached 55%. Thus, the awakened animals began to die about 25 days after irradiation, at which time no further deaths occurred in the animals irradiated in the waking state. When groups of waking dormice were given whole-body doses of 1200 to 12,000 r, survival time fell as the dose increased up to ~3000 r at which dose it leveled off at 4.2 days. In contrast, in irradiated hibernating dormice not awakened after irradiation, survival time fell sharply from 39 days at 1000 r, then leveled off at 23 days at 6000 r, and fell sharply again to reach 14 days at 10,000 r. The survival curves, showed that the limiting 4.2-day phenomenon does not occur in hibernating animals. In waking animals irradiated with 700 r, 10-min prior injection of 500 mg/kg cysteine intraperitoneally was fully radioprotective, no animals dying within 30 days in comparison with 37% mortality in controls. No protection was afforded, however, if the same dose of cysteine was given 3 min after irradiation. Cysteine was also effective when given 15 min before irradiation of hibernating dormice; no animals died during the subsequent 21-day hibernation period and an additional 30-day waking period. Even when cysteine was injected 21 days after irradiation and 1 hr before awakening it was markedly effective as a radioprotectant; the mortality was only 5% in these animals in contrast to 55% in animals not given cysteine. Histologic studies were also conducted in bone marrow and other organs of irradiated dormice to detect differences in radiation effects in the waking and hibernating states. Tissue and cell damage was present in irradiated hibernating animals but its appearance was delayed. Liver adenosinetriphosphate (ATP) content was more than twice as great in hibernating than in waking animals, and within 4 days of rewarming it fell to normal. It was concluded that in the hibernating animal, radiation induces the usual primary reactions, such as free radical formation, but that the concomitant secondary chemical reactions are inhibited until the homoiothermic state is re-established. Cysteine may manifest its radioprotective action by blocking the later reactions. (P.C.H.)

7828 EFFECT OF X RAYS ON THE ENZYME ACTIVITY OF SEEDS OF PISUM RELATIVE TO THE FORMATION OF ACETOIN. Cécile Sosa-Bourdouil and Antoine Sosa (Centre National de la Recherche Scientifique, Gif-sur-Yvette, Seine-et-Oise, France). Compt. Rend., 255: 1767-9(Oct. 8, 1962). (In French)

Dry seeds of Pisum sativum L. and the corresponding enzymatic preparations were irradiated by Co^{60} γ rays. The activity measurements based on the formation of acetoin and the release of CO_2 from pyruvic acid or from a mixture with acetaldehyde are attributable to α-carboxylase. The destruction curves are relative to the apoenzyme function. For a residual activity of 37%, a dose of approximately 3.4×10^6 r is necessary. The activity was also examined in the cotyledons and the plantlets after germination of the irradiated seeds. (tr-auth)

7829 SENSITIVITY TO X RAYS OF THE DEVELOPMENT TIME OF BOMBYX MORI EGGS WHEN THE IRRADIATION IS DONE SEVERAL HOURS AFTER THE START OF INCUBATION. Jean-Marie Legay and Pierre Teulade (Laboratoire de Zoologie Expérimentale, Faculté des Sciences, Lyon). Compt. Rend., 255: 1784-5(Oct. 8, 1962). (In French)

The sensitivity to x rays was measured in Bombyx mori eggs by the variation of the development time as a function of the dose administered. The development time means the interval between the start of incubation and hatching. The eggs were irradiated with doses of 0, 500, 1000, 2000, and 3000 r. The results show an increase in development time with the dose and the absence of all differences for the mortality rate. If the irradiation takes place 5 days after the start of incubation, no increase in the development is found at 2000 r, but the mortality rate is significantly higher. (J.S.R.)

7830 STUDY OF THE INHIBITING EFFECT OF SOME CHEMICAL COMPOUNDS ON THE INDUCTION OF LYSIS AND THE PRODUCTION OF PHAGES, PROVOKED BY THE ULTRAVIOLET IRRADIATION OF LYSOGENIC ESCHERICHIA COLI CULTURES. Michel Faguet (Institut Pasteur, Paris). Compt. Rend., 255: 1810-12(Oct. 8, 1962). (In French)

The inhibiting effect of different chemical compounds on the ultraviolet-induced lysis and phage production was studied. It was shown that adenosine 5-triphosphate is the most active reagent. Its anti-inducing action could be detected at concentrations of 10^{-4} M. (tr-auth)

7831 RADIATION BREEDING OF APOMICTIC PROSTRATE DALLISGRASS, PASPALUM DILATATUM VAR. PAUCICILIATUM. Glenn W. Burton and J. E. Jackson (Univ. of Georgia, Coastal Plain Experiment Station, Tifton). Crop Sci., 2: 495-7(Nov.-Dec. 1962).

A study was made of spaced plants and progeny of the meiotically irregular prostrate dallisgrass from seed un-

treated and treated with 15 and 30 hours of thermal neutrons and 20 and 30 Kr of x rays. It was concluded that the best radiation treatment, 20 hours of thermal neutrons, increased the frequency of R_1 vegetative and floral mutants over 4-fold and nearly doubled the number of vegetative mutant classes. Radiation-induced mutants continued to reproduce by apomixis. Radiation did not induce sexuality in this obligate apomict. No evidence of ergot resistance could be found in some 4,000 R_1 and some 16,000 R_2 plants. Since radiation did no break apomixis, R_2 plants should be designated R_1A_1 (first radiation generation followed by the first apomictic generation). The limited radiation breeding practiced in this study failed to lead to the development of higher yielding strains capable of producing more and higher quality seed. (auth)

7832 EFFECTS OF IRRADIATION ON APOMICTIC COMMON DALLISGRASS. E. C. Bashaw and B. J. Hoff (Texas Agricultural Experiment Station, College Station). Crop Sci., 2: 501-4(Nov.-Dec. 1962).

Irradiation of apomictic common dallisgrass with gamma rays and neutrons produced extensive changes in growth habit and morphological characteristics not previously observed in untreated plants. Radiation caused some superficial changes in vigor and plant size, but many of the aberrants represented true genetic mutations. The more prominent changes observed in the M_1 plants were transmitted uniformly to their M_2 progeny. The radiation treatments had no effect on method of reproduction but drastically reduced fertility of many plants. Radiation caused extensive chromosomal abnormalities in microsporocytes but had no apparent effect on the frequency of aposporous nucellar cells which function as embryo sacs in apomictic common dallisgrass. (auth)

7833 THE MECHANISM OF RADIATION DAMAGE IN THE OVARY OF THE MOUSE. L. A. Kashchenko (Central Research Inst. of Medicinal Radiology, USSR). Dokl. Akad. Nauk SSSR, 147: 217-20(Nov. 1, 1962). (In Russian)

Mice (20 to 22 g in weight) were given a single, whole-body irradiation with a Co^{60} dose of 1000 and 2000 r. The mice were autopsied 1, 2, 3, 5, 7, 10, 12, 14, 20, 24, 36, 40, 48, and 72 hours, and 5 to 7 and 10 days after irradiation. Paraffin sections of the ovary 6 to 10 μ thick were stained with hematoxylin. Ova having well-developed eggs were less subject to damage than ovules not having an egg. The primordial follicles first showed the greatest damage. These disappeared completely 2 to 3 days after irradiation. Death of the primordial follicle began with damage to the egg. The oöcytes of large follicles were resistant to radiation, even though the epithelium of the follicle showed degenerative changes. Damage to the follicle structure is the main reason for the death of the ova. Even though a well-marked preovulation state was frequently noticed, ovulation or the formation of an egg was not observed in a single case. The eggs of large follicles survived a massive dose of 1000 or 2000 r, but the eggs of younger follicles perished after damage to the follicle cells. The mature egg is less dependent on the follicle substrate and can exist for a certain time outside the sphere of the trophic action of the follicle cells. The cells of the follicle epithelium play an important part in the radiation damage to the eggs. (TTT)

7834 VARIATION IN THE CONTENT OF NUCLEIC ACIDS IN THE EXTREMITIES OF AXOLOTLS AFTER IRRADIATION WITH X-RAYS AND AFTER RE-ESTABLISHMENT OF THE ABILITY TO REGENERATE THE EXTREMITIES. N. A. Teplits (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 147: 244-7(Nov. 1, 1962). (In Russian)

A total of 2158 white and black axolotls 10 months in age were given an x-ray dose of 7000 to 10,000 r to both rear extremities after covering the body with a lead sheet 4 mm thick. The first amputation was made 15 to 21 days after the irradiation. A total of 6 or 7 injections were then made daily in the right rear limb in order to re-establish the regeneration of the limb. The several limbs were weighed and analyzed for the RNA and DNA contents. Data are presented on the variation of RNA and DNA content under the following experimental conditions: (1) normal, unirradiated, amputation, and treatment with various preparations; (2) control-simple irradiation and amputation; (3) irradiation, amputation, and treatment with 125 μg RNA; (4) irradiation, amputation, and treatment with 85 μg DNA; (5) irradiation, amputation, and treatment with 27.5 mgs of rat liver protein; (6) irradiation, amputation, and treatment with 10 mgs of acid milk protein; (7) irradiation, amputation, and treatment with RNA and liver protein; (8) irradiation, amputation, and treatment with RNA and acid protein; (9) irradiation, treatment with RNA, and amputation two months later; (10) irradiation, treatment with liver protein, and amputation two months later; (11) treatment with RNA, irradiation two months later, and amputation; (12) irradiation, amputation, and treatment with liver cell nuclei containing some cytoplasma; (13) irradiation, amputation and treatment with pure cell nuclei; (14) irradiation, amputation, and treatment with lyophilized bone marrow; (15) irradiation, amputation, and treatment with a suspension of lyophilized spleen tissue, and (16) irradiation, amputation, and treatment with lyophilized muscle tissue. The results show that irradiation slows down the regenerative ability of the limbs and that the RNA content drops from a normal value of 400 to 230 μg per 100 mgs dry weight, while the DNA content drops from a normal value of 240 to 190 μg per 100 mgs dry weight. As the limbs regain their regenerative capacity, the RNA and DNA contents approach the normal values after the first and second amputations. Treatment with the biological preparations increased the RNA and DNA contents in the newly formed limbs by 20 to 25%. (TTT)

7835 EFFECT OF THE ADMINISTRATION OF ADENINE (LEUCON) ON THE CHANGES OF BLOOD IN IRRADIATION. M. Suzuki, S. Sasagawa, S. Sasaki, and M. Hiroi (Niigata Univ., Japan). Gan no Rinsho, 7: 613-16(1961).

Adenine, one of the purine bases in nucleic acids and a stimulating agent for hematopoiesis, was administered to 7 patients with cancer of the cervix uteri, who were treated with x rays. The patients were irradiated every day except Sunday with a dose of 400 r and at the same time given adenine (leucon), 50 mg per day. Changes in blood were followed up in respect to content of hemoglobin, number of erythrocytes and leukocytes as well as the percentage of neutrophilic leukocytes and lymphocytes. Number of leukocytes decreased at a minimum when the dose of x rays reached 4000 to 5000 r and thereafter showed tendency to increase, the data seemingly indicate that adenine did not prevent leukocytes to decrease, but affected their recovery after a decrease. Adenine also caused the recovery of the percentage of neutrophils and lymphocytes to the normal level. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

7836 ULTRAVIOLET LIGHT INDUCED MUTATION AND DEOXYRIBONUCLEIC ACID REPLICATION IN BACTERIA. C. O. Doudney and Carolyn S. Young (Univ. of Texas, Houston). Genetics, 47: 1125-38(Sept. 1962).

Through a concurrent investigation of the nonlinearity of

the UV-induced mutation curve in strain WP2 and the recovery of DNA synthesis in E. coli following various levels of exposure to UV, evidence has been obtained to support the hypothesis that two basic radiation effects are involved in UV-induced mutation. These effects are blockage of DNA synthesis by UV causing a requirement of RNA and protein synthesis in repair of the UV-damaged DNA synthetic system and the establishment of the photochemical modification (the mutation lesion) which results in mutation with DNA replication. The kinetic examination of recovery of DNA synthesis following UV exposure allowed the measurement of the relative increase in RNA required for recovery of DNA synthesis. The assumption is made that the amount of RNA synthesis required for recovery of DNA synthesis is directly related to the amount of damage blocking DNA synthesis and thus is a measure of the probability that the genetic region under study will be damaged in this way. By multiplying the probability of damage of this type to the WP2 genetic region by the estimated number of mutation lesions (based on a projection to lower doses of the linear portion of the mutation frequency response curve at higher UV doses) a theoretical expression could be developed to account for the nonlinear mutation frequency response at lower UV doses. The measured mutation frequency response at lower UV doses coincided with this theoretically constructed curve, thus supporting the basic premises of the hypothesis. By means of study of the distribution of subunits of DNA obtained from growing, UV-exposed bacteria using the cesium chloride density gradient technique, it was possible to demonstrate that DNA replication is semiconservative after UV exposure, eliminating from consideration those hypotheses for UV-induced mutation which demand a conservative type of DNA replication. In view of the above findings, certain modifications in the general model for UV-induced mutation previously described by Doudney (1961) are presented and discussed. (auth)

7837 SELECTION FOR LEUCOCYTE COUNT IN THE HOUSE MOUSE AND SOME PHYSIOLOGICAL EFFECTS. J. A. Weir and G. Schlager (Univ. of Kansas, Lawrence). Genetics, 47: 1199-1217(Sept. 1962).

The mean of total leucocyte counts from 118 outbred mice (T strain) was 9121 cells per cubic millimeter (log count 3.960 ± .0128). Selections were based on family and individual merit in a closed system and matings were brother by sister. By generation 13, the maximum difference between strains was achieved with arithmetic and log counts as follows: LCH 17,500 (4.244 ± .0162); LCL 4,000 (3.602 ± .0318). Although the selection differential was uniform in the two lines, the intensity of response was greater in LCH. Response in the LCL was more gradual, but continued until the end of the experiment. However, the outbred T mice also followed a downward trend, indicating environmental influences. Heritability estimates by four methods were: 22.4, 20.3, 18.7, and 17.4 percent. The major portion of the difference in leucocyte count between LCH and LCL is accounted for by lymphocytes. LCH mice had more cells of all categories. In LCL mice the number of granulocytes increased under downward selection pressure for total count. The selected lines did not differ significantly in numbers of progeny or weaning weight. At the end of the experiment, LCH families were albino and leaden, LCL leaden brown. There were no significant differences between strains in resistance to a standard dose of live organisms of S. typhimurium, the toxic effects of massive doses of heat-killed organisms, or to reinoculation with live organisms after immunization. After an acute dose of 650 r of x rays, survivals were: LCH 24/30 (80 percent); LCL 9/25 (36 percent). (auth)

7838 A METHOD FOR SELECTING RADIATION-SENSITIVE MUTANTS OF ESCHERICHIA COLI. P. Howard-Flanders and Lee Theriot (Yale Univ., New Haven). Genetics, 47: 1219-24(Sept. 1962).

A method for obtaining by selection a certain class of sensitive mutants of Escherichia coli is reported. The method depends upon contra-selection by irradiated T1 bacteriophage. (auth)

7839 RELATIVE GENETIC LOADS DUE TO LETHAL AND DETRIMENTAL GENES IN IRRADIATED POPULATIONS OF DROSOPHILA MELANOGASTER. C. S. Chung (Univ. of Wisconsin, Madison). Genetics, 47: 1489-1504 (Nov. 1962).

The effect of irradiation on the relative genetic loads due to detrimental and lethal genes expressed by inbreeding was studied by extracting 267 second chromosomes of Drosophila melanogaster and by examining their effects on viability in homozygous and heterozygous conditions for one nonirradiated and six irradiated populations. These irradiated groups had been maintained in the laboratory for several years after cessation of the irradiation. No consistent relation of these loads to the radiation history of the different population was found. The data indicated that the irradiated stocks are nearly at equilibrium for both detrimental (D) and lethal (L) loads. The overall mean ratio of D to L was estimated at .58. Slight increase of D but constant L with crowding condition of culture suggested that the D to L ratio may be underestimated under uncrowded laboratory conditions. The inbred genetic load effected through sterility was expressed in terms of sterile equivalent with two components of partial and complete sterility. Over both sexes the two components were found to be equally important in their harmful effects. Approximately one fourth of the total inbred load manifested through lowered viability and sterility is contributed by sterility factors. The second chromosomes of the irradiated populations in heterozygous arrangement with cn bw^D or Cy O marker chromosomes caused significantly reduced viability below the similar combinations of nonirradiated population. This increased heterozygous load due to irradiation was in the magnitude of .0225 ± .0084. Implication of this finding relative to degree of dominance of detrimental genes is discussed. (auth)

7840 THE ROLE OF RECOVERY MECHANISMS AND OXYGEN EFFECTS UPON CHANGES IN RADIATION SENSITIVITY IN SPERM TREATED IN MATURE MALES AND FERTILIZED FEMALES OF DROSOPHILA. Mary L. Alexander (Univ. of Texas, Austin; Anderson Hospital and Tumor Inst., Houston, Tex.; and Inst. of Animal Genetics, Edinburgh). Genetics, 47: 1505-18(Nov. 1962). (TID-16845)

An increase in biological damage in sperm treated in inseminated females was observed after treatment with either neutrons or x rays. Recovery mechanisms cannot account for the high sensitivity with neutron treatment. The absence of recovery mechanisms was indicated by equal percentages of biological damage observed the first and second day after treatment with 2 Mev neutrons in air or with 14 Mev neutrons in nitrogen. With x-ray treatment, higher percentages of translocations and sex-linked lethals were observed in the treatment of sperm in inseminated females than in males. The enhancement in chromosome breakage, measured as translocations, was greater in sperm treated in fertilized females than the increase in sex-linked lethals with x-ray treatment in air. The presence of oxygen (air) appears to be correlated with the enhancement in chromosome breakage in sperm treated in fertilized females. In nitrogen, the relative increases in

translocations and sex-linked lethals in sperm treated in females were similar for comparisons of two-day totals. The possibility of a postradiation enhancement of radiation damage was observed when mature sperm were treated in inseminated females with x rays in the presence of nitrogen gas. The percentages of translocations and sex-linked lethals were higher in the second day after treatment than the damage for the first day. The data indicate that an explanation for the increase in radiation sensitivity of mature sperm treated in fertilized females involves more than one factor, the relative importance depending upon the type of radiation and conditions at the time of irradiation. The neutron data show that the chromosomes change in some way to become more sensitive to radiation injury after fertilization. The x-ray data indicate that there may be differences in recovery occurring in genetic damage in sperm treated in males and inseminated females and that there is an increase in chromosome breakage which is associated with the increased sensitivity. There is also a correlation of an increase in chromosome breakage and the presence of oxygen and a possible postradiation enhancement of radiation damage which may be associated with the presence or absence of oxygen. (auth)

7841 SKELETAL ABNORMALITIES IN THE F_1 GENERATION OF MICE EXPOSED TO IONIZING RADIATIONS. U. H. Ehling and M. L. Randolph (Oak Ridge National Lab., Tenn.). Genetics, 47: 1543-55(Nov. 1962).

Results are reported from an experiment designed to test the feasibility of measuring part of the overall genetic damage of irradiation by means of skeletal studies in the F_1 generation. Male 101-strain mice were irradiated, using different radiation sources and conditions, and subsequently the males were mated to adult C3H-strain females. Progeny was selected to sample gametes irradiated in different stages of spermatogenesis. The F_1 generation was sacrificed at 26 to 28 days of age and animals were processed for skeletal study by a modification of Dawson's technique. Observed abnormalities were classified according to whether they occurred only once in the whole experiment (Class 1) or more than once (Class 2). For Class-1 abnormalities, a highly significant increase in frequency was observed in offspring of irradiated males. This increase is due largely, if not wholly, to irradiation in postspermatogonial stages. For Class-2 abnormalities, no differences between irradiated and control groups could be detected. Therefore, we conclude that the classification used served its original purpose of distinguishing between the effects of newly occurring dominant genetic changes and variability from environmental causes. With the methods used, studies of skeletal abnormalities in the first generation can detect part of the overall genetic damage from irradiation. (auth)

7842 STUDIES ON THE REFRACTORY PERIOD FOR THE INDUCTION OF RECESSIVE LETHAL MUTATION BY X RAYS IN PARAMECIUM. R. F. Kimball and Stella W. Perdue (Oak Ridge National Lab., Tenn.). Genetics, 47: 1595-1607(Nov. 1962).

It has been shown previously that very few recessive lethal and slow growth mutations can be detected in paramecia irradiated during G2 and early prophase. This paper rules out various artifacts that might influence detection of mutations and shows that this is indeed a period during which very few mutations can be induced. Various hypotheses to account for the observations are discussed in relation to work with other organisms. It is concluded that some form of post-irradiation repair, possibly of more than one kind, is probably involved. Little if any final mutation appears to be formed at the time of irradiation; almost all passes through an intermediate, reparable stage. (auth)

7843 THE POSSIBLE ROLE OF MOMENTUM IN RADIATION DOSIMETRY. J. E. Turner (U. S. Atomic Energy Commission, Washington, D. C.) and H. Hollister. Health Phys., 8: 523-32(Oct. 1962).

Physical quantities, such as kind and energy of radiation, are used together with energy absorbed per unit mass, or the rad dose, in descriptions of dose-effect experiments. The net effects of different physical as well as biological factors are described in terms of the number called relative biological effectiveness (RBE). In this investigation ways were sought to generalize the definition of radiation dose to include other physical quantities besides absorbed energy which would largely remove variations in RBE arising from variations in the physical parameters in an experiment. From experimental RBE values a number of physical quantities were calculated corresponding to a 1-rem dose of both neutron and γ-radiation from monoenergetic sources over energy ranges from about 0.4 to 10 Mev. It was found that the quantity $\omega = \alpha_1 E_{abs} + \alpha_2 P_{abs}$ (in which α_1 and α_2 are constants, E_{abs} is energy absorbed per gram (rad dose), and P_{abs} is the momentum absorbed per gram) remains essentially constant for a 1-rem dose of any combination of neutrons and photons having any energy distributions within the ranges of energies considered. If ω applies generally in dosimetric situations, then it follows that the observed variation of RBE due to purely physical parameters in an experiment can be interpreted in terms of the value of the ratio P_{abs}/E_{abs}. The relationship of arguments presented here to Hurst and Ritchie's generalized principle of dosimetry is discussed. It is suggested that a much broader theoretical and experimental approach to radiation dosimetry is warranted than has heretofore apparently been carried out. (auth)

7844 POSITRON SCANNER FOR LOCATING BRAIN TUMORS. S. Rankowitz, J. S. Robertson, W. A. Higinbotham, and M. J. Rosenblum (Brookhaven National Lab., Upton, N. Y.). IRE (Inst. Radio Engrs.) Intern. Con. Record, 9: 49-56[1961]. (BNL-6041)

A system is described that makes use of positron emitting isotopes for locating brain tumors. This system inherently provides more information about the distribution of radioactivity in the head in less time than existing scanners which use one or two detectors. A stationary circular array of 32 scintillation detectors scans a horizontal layer of the head from many directions simultaneously. The data, consisting of the number of counts in all possible coincidence pairs, are coded and stored in the memory of a Two-Dimensional Pulse-Height Analyzer. A unique method of displaying and interpreting the data is described that enables rapid approximate analysis of complex source distribution patterns. (auth)

7845 DETERMINATION OF INDUCED RADIOACTIVITY IN THE SECOND COSMIC SPACESHIP. V. V. Matveev and A. D. Sokolov. Iskusstv. Sputniki Zemli, No. 11, 42-3(1961).

The residual γ activity in a biological specimen on board the second Soviet cosmic spaceship was determined. The biological specimens were in the form of cylinders (3.8-cm dia., 4-cm long) with a total weight of 86 g. The activity of the specimens was measured after return to earth, and it was found that if there was a residual γ activity 15 days after the return to earth it did not exceed 10^{-10} g equivalents of Ra. (OTS)

7846 FERMENTATIVE ACTIVITIES OF CONTROL AND RADIATION-"KILLED" SPORES OF CLOSTRIDIUM

BOTULINUM. Ralph N. Costilow (Michigan State Univ., East Lansing). J. Bacteriol., 84: 1268-73(Dec. 1962).

Spores of Clostridium botulinum 62-A exposed to high levels of ionizing radiation will undergo the initial steps in germination as rapidly as control spores. Manometric experiments demonstrated that these irradiated nonviable spores would ferment a tryptic digest of casein (Trypticase) at an increasing rate during germination, with the production of CO_2 and H_2. There was, however, an increasing lag in the development of rapid rates of fermentation as the radiation level was increased. Such a lag could be simulated by the addition of chloramphenicol, and the two effects were additive. By using high spore concentrations (about 8 mg/ml), it was possible to detect the fermentation of a number of individual amino acids and of glucose. Irradiation of spores at 8.3×10^5 rads had no measurable effect on the fermentation of L-arginine or glucose, or on the endogenous rate, but it partially inhibited the Stickland reaction with L-alanine and L-proline as substrates. The endogenous activity and the L-alanine, L-proline fermentation were also inhibited by chloramphenicol to basic levels which were the same in both control and irradiated spores. Neither the L-arginine nor glucose fermentation was inhibited by this antibiotic. The data indicate that spores of C. botulinum 62-A contain basic levels of the enzymes required for their primary catabolic processes, and that, as expected, ionizing radiation levels sufficient to render the spores nonviable do not significantly affect these enzymes. Furthermore, it is indicated that spores exposed to radiation levels of up to 1.25×10^6 rads retain the ability to synthesize new protein, although it appears to be somewhat impaired. (auth)

7847 EFFECTS OF X-IRRADIATION ON THE DEVELOPMENT OF EYE PIGMENTATION IN THE MOUSE. Louis J. Pierro and Herman B. Chase (Univ. of Connecticut, Storrs and Brown Univ., Providence, R. I.). J. Exptl. Zool., 149: 161-9(Apr. 1962).

C57 Black/10Ch mice received a single dose of 1,000 r head x irradiation at various times during the first 12 days after birth. Irradiation on the day of birth or at four days interfered with pigment accumulation in the eye between 8 and 16 days; irradiation at eight days, with pigment accumulation between 12 and 16 days. Irradiation at 12 days appeared to have no effect on pigment accumulation. Histological studies indicated that x irradiation either on the day of birth or at eight days interfered with the development of the pars ciliaris retina. Development was more markedly inhibited after irradiation at birth than it was after irradiation at eight days. In addition, irradiation on the day of birth also interfered with pigment granule synthesis in certain epithelial melanocytes in the ciliary-iris region. Since better than half of the cells normally found in the pars ciliaris retina are epithelial melanocytes, interference with development of this region presumably accounts, for the most part, for the reduced pigment accumulation in irradiated eyes. It seems probable that the effect of x irradiation on the development of eye pigmentation should be considered as an extension of the radiosensitivity of the developing retina. (auth)

7848 REACTIONS OF THE X-IRRADIATED EMBRYONIC EYE IN A NORMAL FIELD, AND VICE VERSA. Roberts Rugh and Rhoda H. Van Dyke (Columbia Univ., New York). J. Exptl. Zool., 149: 217-31(Apr. 1962).

Normal and/or x irradiated optic vesicle of stage 29 in Amblystoma punctatum may be transplanted to normal or to irradiated hosts of the same age, and will heal, take, and survive. The results are best when the transplants are made immediately after x irradiation. X irradiated embryos of Amblystoma, exposed at stage 22 to 250 r, may survive until the controls reach stage 42 and then succumb. These x irradiated embryos are always stunted, and exhibit lordosis or kyphosis, edema, and failure in development of the eyes, limbs, and balancer. One or more optic vesicles (normal controls or x irradiated) may be transplanted to the flank of a normal host and the success in development will depend entirely upon the degree of x irradiation insult of each case. The flank position allows for better development than in the head. The central nervous system of the embryo appears to be particularly radiosensitive, muscles less so and epidermis least affected. Lens formation (induction) appears to be independent of the viability of the inducting cells, since x-irradiated optic vesicles can induce an essentially complete (though reduced) lens with epithelium. The precursors of the lens are apparently undamaged, being outer ectoderm. The spinal cord (at stage 38) also shows reduction in cell volume and necrosis, following x irradiation which occurs at a time long before its differentiation (stage 22). There is no evidence of toxic substances emanating from the x irradiated transplant to the surrounding normal host tissue, or from the x irradiated host to the normal transplant. It is likely that the transplanted optic vesicle develops as in a tissue culture in which, in the case of the irradiated host, the culture conditions are far from ideal. Nevertheless the optic vesicle possesses intrinsic potentials for development which survive for a period considerably longer than the surrounding necrogenic tissue of the x irradiated host. It is apparent from this study that once the eye precursors are damaged by ionizing radiations no amount of normal surrounding tissue can prevent its ultimate and complete deterioration. However, if the eye is left in the x irradiated larva it succumbs, along with the host, before it would in a more favorable environment. (auth)

7849 RADIATION SURVIVAL CURVES OF CLOSTRIDIUM BOTULINUM SPORES. E. Wheaton (American Can Co., Barrington, Ill.) and G. B. Pratt. J. Food Sci., 27: 327-34(July-Aug. 1962).

Survival curves were obtained for massive concentrations of spores of Clostridium botulinum strain 12885A when subjected to a wide range of gamma radiation doses under various conditions. The spore concentrations ranged from 37,000 to 64,800,000,000 per ampoule, with no recovery at 5 Mrad or more. Only at lower doses were observed survival counts compatible with classical hit theory. More than one hit is apparently required to inactivate the Cl. botulinum spore by gamma radiation. The number of hits required for inactivation is estimated at somewhere near 13. Freeze-dried spores exhibited less radioresistance in the dry state than when resuspended in neutral phosphate buffer. Spore suspensions in neutral phosphate buffer exhibited less radioresistance when irradiated under air than when irradiated under nitrogen. Spores exhibited less radioresistance suspended in phosphate buffer than in a nutrient medium (pork-pea infusion). Changes in concentration of spores over a range of 37×10^3 to 53×10^9 did not significantly affect the percent survival for a given dose except in the tail area. Regardless of spore concentration, a so-called tailing off of surviving spores was observed at the higher dose levels employed for varying spore concentrations. The tailing off phenomenon did not appear to follow the classical hit theory. (Public Health Engineering Abstracts, 42: No. 10, Oct. 1962.)

7850 HOMOGRAFT REACTION IN MOUSE RADIATION CHIMERAS. I. INDIRECT EVIDENCE FOR GRAFT-

ANTI-HOST ACTIVITY. Gino Doria (Oak Ridge National Lab., Tenn.). J. Immunol., 89: 453-8(Oct. 1962).

A graft-against-host homograft immune reaction could be detected when spleen cells from homologous chimeras were tested. This reaction was elicited only by spleen cells from 30-day-old chimeras in which F_1 hybrid mice were the irradiated hosts and parental strain mice the bone marrow donors. The significance of this finding was discussed in a tentative analysis of the problem of the immune status of radiation chimeras. (auth)

7851 HOMOGRAFT REACTION IN MOUSE RADIATION CHIMERAS. II. DIRECT EVIDENCE FOR GRAFT-ANTI-HOST ACTIVITY. Gino Doria (Oak Ridge National Lab., Tenn.). J. Immunol., 89: 459-62(Oct. 1962).

Homologous bone marrow chimeras were tested by a direct method for a graft-anti-host immune reaction. This type of reaction was detectable at 7 days and maximal at 15 days after irradiation and bone marrow treatment. A possible relation between homograft reaction and lymphatic damage in the secondary disease was discussed. (auth)

7852 NEUROPATHOLOGIC INVESTIGATIONS OF THE X-IRRADIATED EMBRYO RAT BRAIN. L. Roizin, R. Rugh, and M. A. Kaufman (Columbia Univ., New York). J. Neuropathol. Exptl. Neurol., 21: 219-43(Apr. 1962).

Embryonic x irradiation of rat embryos with 150 r at 8.5 and 9.5 gestation days produced a wide variety of maldevelopments in the fetuses and post natal animals. Macroscopic variations ranged from exencephaly (herniation of brain) to other severe malformations including porencephaly, telencephalic defects, and ventricular dysplasias, to undersized (stunted) brains which appeared to be topographically normal. The salient microscopic features of these maldevelopments were various degrees of cytoarchitectural alteration and disorganization associated, at times, with necrobiotic changes. The cellular arrangements or patterns of the subependymal or periventricular regions of the lateral and 3rd ventricles often appeared disorganized. Disruption of the ependymal lining was also noticed associated at times with displacement or extrusion of ependymal cells into the ventricular cavity as well as islands of conglomerated cells or groups in rosette formation and random mitotic figures. Electron microscope studies disclosed alteration of the fine structural organization of the nucleus, nuclear membranes, ergastoplasm, Golgi complex, mitochondria and the presence of large numbers of vesicles of the lysosome type. Some blood vessels presented intimal proliferation associated, at times, with irregular protrusions which, occasionally, appeared detached and within the vascular lumen. The anomalies appear to have no relation to the position of the embryos within the uterus, or to the slight differences in the stages of development at the time of x irradiation among the members of the same litter. While genetic factors may be involved, other possible pathogenic mechanisms are to be investigated. A few rat offspring appeared to escape obvious injury from intrauterine 150 r x irradiation at 8.5 and 9.5 g.d. Although they developed into apparently normal animals, they should not be accepted as truly normal without further studies of their functional capacities. (auth)

7853 BIOCHEMICAL EFFECTS OF γ-IRRADIATION ON THE SUCCINOXIDASE SYSTEM, IN VITRO. S. Tanaka, S. Ganno, and H. Hatano (Kyoto Univ.). J. Radiation Res. (Japan), 1: 120-2(1960). (In English)

The succinoxidase system and each constituent enzyme, (succinic dehydrogenase and cytochrome oxidase), which are obtained from liver of mice and rats and from the heart of the cow, were irradiated in vitro with Co^{60} γ rays. Inactivation of the enzyme systems was observed to occur with relatively large doses of γ radiation. Succinic dehydrogenase was found to be more radiosensitive than cytochrome oxidase in all preparations. Effect of γ irradiation on the enzyme systems localized in mitochondria and on the nuclei of rat liver was compared. The enzyme systems in the nuclear fraction were relatively more radiosensitive to γ inactivation than those in the mitochondrial fraction. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

7854 EFFECT OF RADIATION ON MALE MOUSE AND RAT FERTILITY. A. W. Craig, B. W. Fox, and H. Jackson (Christie Hospital, Manchester, Eng.). J. Reprod. Fertility, 2: 466-72(Nov. 1961).

The effect of whole-body irradiation with 200, 300, and 500 r on fertility was examined by systematic weekly matings of the treated animals. In both species, irradiation with 300 r produced a short period of sterility associated with oligospermia at ~45 days after treatment in the mouse and 65 days in the rat. Histological examination showed that the main effect was on the spermatogonial stages but there were obvious differences in the timing and extent of the radiation effects in the 2 species. Absence of prespermatocytes was noted 2 days after irradiation of mice with 300 r, due to interference with type B spermatogonia. At 14 days after treatment, there was evidence of regeneration and by 21 days spermatogonia and resting spermatocytes (prespermatocytes) were present. The remainder of the seminiferous epithelium during this time underwent maturation depletion. In contrast, the histological picture in rats was essentially normal 2 days after 300 r. The time from treatment to the onset of sterility is a measure of the overall duration of spermatogenesis. Busulphan, a bifunctional alkyl sulfonic ester, closely resembled radiation in its action, since it produced only 1 sterile phase commencing about 10 weeks after treatment, and changes in testis histology were similar in both cases. (P.C.H.)

7855 INFLUENCE OF MERCAPTOETHYLAMINE ON RADIATION-INDUCED LETHAL FACTORS. T. Sugahara and T. Tanaka (National Inst. of Genetics, Mishima, Japan). Kokuritsu Idengaku Kenkyujo Nempo, 9: 112-13(1959).

Male mice in 4 different groups were mated with females every week: whole-body single irradiation with a dose of 200 r; single peritoneal injection of MEA 0.5 mg/g; administration of MEA 0.5 mg/g before irradiation (200 r); and administration of MEA 0.5 mg/g after irradiation (200 r). The lutein body, implantation, and living fetus count in female mice at the 12th-14th day after mating were observed. The dominant lethals appeared only in group 2 in a significantly high frequency during the first week. It was, therefore, supposed that the sperm at this stage had already left the testicles, mixed with another secretion, so that it was easy for it to absorb MEA. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

7856 EFFECT OF LONG-TERM γ-IRRADIATION ON THE GERMINAL CELLS IN MICE. K. Tsuchikawa (National Inst. of Genetics, Mishima, Japan). Kokuritsu Idengaku Kenkyujo Nempo, 10: 97(1960).

The mating rate and dominant lethal rate, which were studied by experimental crossing of normal males and irradiated females once per 10 days, were considerably decreased until the 5th week after x irradiation with 400 r, and recovered completely to the normal level in the 8th week. In a group of mice irradiated with 100 r spermatogenesis was nearly normally developed, without any considerable changes. The dominant lethality was not related to variation of ED/IMP-ED. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

7857 IONIZING RADIATIONS AND CONGENITAL ANOMALIES OF THE NERVOUS SYSTEM. Roberts Rugh (Columbia Univ., New York). Military Med., 127: 883-907 (Nov. 1962).

There is no longer any doubt that penetrating ionizing radiations can so interfere with development that congenital anomalies may result from exposures at any time from fertilization of the ovum until after birth, and the majority of such anomalies involve the nervous system. The effects of ionizing radiations at different stages of embryonic development are related both to tissues and organs actively differentiating at the time, and the level of exposure. The earliest cleavage stages are the most radiosensitive in terms of lethality and no threshold has been established. Irradiation during organogenesis is most likely to produce gross congenital anomalies, particularly of the central nervous system. Exposures during the later stages of pregnancy show better survival but are more likely to respond in terms of functional rather than gross structural anomalies. Such late fetuses possess gonads and germ cells which can accumulate the mutations induced by ionizing radiations, for which no mutational threshold has been established. Ionizing radiations produce their effects by killing or maiming cells, or producing mutations. When cells are killed the resultant fetus will be proportionately deficient. When maimed cells persist, they may so interfere with morphogenesis that either or both structural and functional defects follow. The terms survival, recovery, and normality have been confused in radiobiological literature. They are not synonymous. It is becoming clearer that an irradiated embryo may indeed survive, appear to be recovered but in fact exhibit morphological and/or functional deviations from the normal at various periods during the post-natal life of the individual. In view of animal experiments showing deleterious effects of 10 rads delivered to the embryo, and the probability that the human embryo of comparable developmental stage is similarly radiosensitive, it is suggested that this dose be the limit allowed to the early human embryo or duing its first 6 weeks of development. This dose is more than that estimated as the 30 year accumulated gonad exposure from natural, medical and fallout sources. A suggestion is made relative to the mechanism of embryonic damage by ionizing radiations, affecting the DNA — specific differentiation protein chain reaction. (auth)

7858 MUTAGENIC EFFECT OF X-RAYS ON MOTHS. Hugo P. Kortschak (Hawaiian Sugar Planters' Association, Honolulu). Nature, 196: 490(Nov. 3, 1962).

Data on the mutagenic effect of x rays on moths are discussed. (C.H.)

7859 EFFECTS OF 'VISIBLE' LIGHT ON 5-BROMOURACIL-LABELLED DNA. A. Wacker, H. D. Mennigmann, and Waclaw Szybalski (Univ. of Wisconsin, Madison). Nature, 196: 685-6(Nov. 17, 1962).

Results are reported from a study of the effect of visible light on the incorporation of 5-bromodesoxyuridine, labeled with C^{14}, into the desoxyribonucleic acid (DNA) of intact cells of Bacillus subtilis, a thyminine-requiring strain of Escherichia coli, or protein- and RNA-free DNA isolated from genetically transforming strains of B. subtilis. The photochemical changes produced by a 36 hr illumination from a fluorescent lamp of labeled DNA were followed by determination of the chromatographic behavior of the C^{14} label after 14 hr at 25°C or 1 hr at 95°C of 70% perchloric acid hydrolysis of the non-illuminated and illuminated DNA, and by measuring the effect of illumination on the buoyant density of labeled DNA. Similar experiments using long-wave ultraviolet light gave essentially identical results, indicating that the effects of visible light are probably attributable to its ultraviolet components. Reaction mechanism involved in the dehalogenation during irradiation of labeled DNA was investigated by density measurements on the halogenated DNA before and after illumination. Results are presented graphically and are discussed. (C.H.)

7860 PHOTOREACTIVATION AFTER DIVISION. John Calkins (Univ. of Texas, Houston). Nature, 196: 686-7(Nov. 17, 1962).

Division before death was observed in a strain of Tetrahymena pyriformis following ultraviolet irradiation in doses ranging from 900 ergs/mm^2 (LD_{50}) to 4000 ergs/mm^2. This strain of Tetrahymena was tested for photoreactivation after division using two separate doses of photoreactivating light. Results were compared with those on a group of non-irradiated animals and a group of animals irradiated with the same ultraviolet dose and receiving immediate but lower intensity of photoreactivation. A greater ability to reactivate animals was found after two divisions than after one division. Possible reaction mechanisms involved are discussed. (C.H.)

7861 LETHAL EFFECTS IN TADPOLES OF XENOPUS LAEVIS (DAUDIN) AFTER IRRADIATION WITH HIGH-ENERGY ELECTRONS. C. Eberhard Buchheim (Universität, Bern). Nature, 196: 902-3(Dec. 1, 1962).

Tadpoles of Xenopus laevis in a small water phantom were exposed to doses of 500, 1000, 1500, 2000, and 2500 r high-energy electrons from a 31-Mev betatron. Investigations were made concerning the influence of dose-rate, total dose, and site of the irradiated animals in the phantom on lethality. The experiments were repeated after one year. Data are tabulated. After a single dose of 500 r the lethality of the tadpoles was considerably higher at a dose rate of 300 r/min than at 50 r/min. The lethality of the animals increased with the depth of the phantom and also when the dose and dose-rate were constant. This phenomenon was attributed to rapid changes in linear-energy transfer with increasing depth in water. (C.H.)

7862 INFLUENCE OF IONIZING RADIATION ON GLUTAMINASE ACTIVITY IN MOUSE BRAIN AND LIVER. L. Ababei, S. Schiau, S. Čapîln, E. Ghizari, R. Stoenescu, and P. Stefánescu (Inst. of Normal and Pathological Physiology, Academy of Sciences, Rumanian SSR). Nature, 196: 1223-4(Dec. 22, 1962).

A significant inhibition of glutaminase activity was demonstrated in the brain and liver of mice after whole-body exposure for 58 min to 500 r x radiation. The inhibition increased progressively for 48 hr after irradiation. Similar results were reported previously for carboxypeptidose activity. It was concluded the decrease of the activity of these mitochondrial enzymes may be explained as a consequence of changes in the synthesis of new proteins, and therefore also of enzymal proteins. Since both enzymes have active –SH groupings, it is postulated they may be inhibited by the direct action of x rays on these groupings. (C.H.)

7863 CHANGES OF THE LEUCOCYTES DURING RADIATION THERAPY OF MALIGNANT TUMOURS. J. Ďurkovskii, V. Eichnerová, and I. Kuzma (Oncological Research Inst., Bratislava). Neoplasma, 9: 507-16(1962). (In German)

In a group of 370 patients, whose various malignant diseases were radically irradiated, the quantitative changes of the leucocytes during radiation therapy were followed. The dependence of the mentioned changes from the integral doses was confirmed. The sex of the patients, the preceding

surgical or radiation therapy, and also the kind of the irradiated tumor influenced the rise of the radioinduced drop of leucocyte count. In 82 patients a trial of the therapeutical influence of the radiation leucopenia was provided. From various applied therapeutical means ACTH and Prednison proved to be the most effective. (auth)

7864 THE EFFECTS OF ULTRAVIOLET-IRRADIATED POLYURIDYLIC ACID IN CELL-FREE PROTEIN SYNTHESIS IN E. COLI. Lawrence Grossman (Brandeis Univ., Waltham, Mass.). Proc. Natl. Acad. Sci. U. S., 48: 1609-14(Sept. 1962).

The incorporation of U-C^{14}-L-phenylalanine prepared from poly-L-phenylalanine from Escherichia coli into acid-insoluble material and poly-L-phenylalanine following ultraviolet irradiation of polyuridylic acid was examined. Irradiation of the polyuridylic acid with doses of ultraviolet light from 24 to 72×10^4 ergs/mm^2 resulted in a marked depression in C^{14}-phenylalanine incorporation and was accompanied by an increase in C^{14}-serine uptake into both acid-soluble material as well as polyphenylalanine. (auth)

7865 PROLONGED SUPPRESSION BY X-RAY OF ADAPTATION FOR THE SECONDARY ANTIBODY RESPONSE. Richard J. Porter (Univ. of Michigan. Ann Arbor). Proc. Soc. Exp. Biol. Med., 111: 583-4(Dec. 1962).

Rabbits adapted by previous exposure for vigorous secondary antibody responses to BGG lost this adaptation after sublethal x radiation and were able to give only primary responses to reinjection of the antigen 24 weeks after irradiation. Data are presented indicating that the loss of secondary adaptation was not a result of general damage to the antibody-forming system. These results have implications both for understanding of the immune response and for practical problems of immunization. (auth)

7866 ATHEROSCLEROSIS IN THE RAT. EFFECT OF X-RAY AND A HIGH FAT DIET. Harold Gold (Mount Sinai Hospital, Cleveland). Proc. Soc. Exp. Biol. Med., 11: 593-5(Dec. 1962).

Forty-two albino Wistar rats, average weight 133 g, fed on a supplemented high fat diet, were divided into 2 groups. One group was treated with 2500 r x rays to the thorax, and the other kept on the high fat diet, but not irradiated. The rats were killed 20 to 28 weeks after completion of irradiation. Marked atherosclerotic lesions were observed in the coronary arteries of 38.8% of the irradiated group and in 22.7% of the group on the high fat diet alone. In the pulmonary arteries similar changes were noted in 25% of the irradiated group and none in the unirradiated group. Previous studies showed that in 8 to 15 weeks post-irradiation marked coronary lesions were present in 26.6% of the irradiated group and none in the unirradiated. It is suggested that x irradiation accelerates the process that develops with diet and with time. (auth)

7867 RESPIRATION OF GAMMA IRRADIATED BRUCELLA ABORTUS AND MYCOBACTERIUM TUBERCULOSIS. Tai Hew Ahn, Hisako Nishihara, Charles M. Carpenter, and George V. Taplin (Univ. of California, Los Angeles). Proc. Soc. Exp. Biol. Med., 111: 771-3(Dec. 1962).

Lyophilized Br. abortus 19 and M. tuberculosis H37RV were exposed to various doses of gamma irradiation from a cobalt-60 source and tested for oxygen uptake on suitable substrates. Cells exposed from 750,000 to 800,000 r failed to grow on appropriate culture media, yet continued to respire at a rate from 40 to 50% of that of the non-irradiated cells. (auth)

7868 ULTRASTRUCTURAL MODIFICATION AND HISTOLOGY OF THE NEURONS OF THE SUPEROPTIC NUCLEUS IN RATS EXPOSED TO IRRADIATION. R. Bruno (Università, Messina, Italy), S. Greco, G. Pisani, and A. Santoro. Radiobiol. Latina, 5: 1-31(Jan.-Mar. 1962). (In Italian)

Investigations with histological methods and the electronic microscope were made on the behavior of neurones of the supraoptic nucleus in the rat following irradiation with 1500 rad of x and Co^{60} radiations. Attention is given to the alterations both of the nucleus and the cytoplasm which were evident right after the end of the irradiation. In the majority of cells, the alterations regressed quickly within some hours following the irradiation and only a few elements showed an evolution towards a degenerative process, which led in some months to the destruction of the affected neurone. (auth)

7869 STUDY OF THE MODIFICATION OF GLUCURONEMIA FOLLOWING IRRADIATION. S. Greco, G. Lombardo, M. Scaccianoce, and F. Spina (Università, Catania, Italy). Radiobiol. Latina, 5: 33-7(Jan.-Mar. 1962). (In Italian)

Variations in the serum contents of glucuronic acid in subjects suffering from malignant tumors who had been irradiated before and after roentgentherapy were investigated. The variations observed consisted in a slight but constant decrease of glucuronemia. It is suggested that the reduction of blood levels of glucuronic acid following irradiation might be related to the reaction of the mesenchyme to destructive and regenerative processes. Probably, the connective tissues utilize the circulating glucuronic acid for the synthesis of mucoproteins. (auth)

7870 CONTRIBUTION TO THE STUDY OF THE IRON KINETICS SUBORDINATED BY SUBJECTION TO ROENTGEN IRRADIATION. INVESTIGATION CONDUCTED BY USE OF Fe^{59}. S. Greco, E. Barbagallo, G. Gasso, and G. Tamburino (Università, Catania, Italy). Radiobiol. Latina, 5: 39-42(Jan.-Mar. 1962). (In Italian)

A study of iron utilization in the plasma and hemoglobin was made possible by the use of Fe^{59} in subjects suffering from malignant tumors who had been treated by roentgen-irradiation. A reduction of iron-utilization in hemoglobin was found. The reduction was attributed to the decreased iron-need of the erythropoietic matrix which, due to ionizing radiations, undergoes a decrease of erythroregenerative processes as shown by an elongation of the intercynetic period of erythroblasts taking up iron. (auth)

7871 MODIFICATION OF THE ULTRASTRUCTURE OF THE GRANULE OF THE CEREBELLUM OF THE RAT FOLLOWING THE ACTION OF IONIZING RADIATION. F. Finocchio (Università, Messina, Italy), S. Greco, G. Pisani, and L. Portigliotti. Radiobiol. Latina, 5: 43-60(Jan.-Mar. 1962). (In Italian)

Studies were made on the ultrastructural modifications of cerebellar granule of rats treated by irradiation of the head with x and gamma radiation to doses between 100 and 3000 rad. The observations were performed in animals sacrificed between the end of the irradiation and 24 hours later. It is shown that even the cerebellar granule, along with other neurons, show signs of suffering right after irradiation and that the alterations evolve differently with time after irradiation. (auth)

7872 MODIFICATION OF THE LIPOGRAMS AND CHOLESTEROLEMIC FRACTIONS FOLLOWING IRRADIATION. S. Greco, G. Lombardo, M. Scaccianoce, and F. Spina (Università, Catania, Italy). Radiobiol. Latina, 5: 61-9(Jan.-Mar. 1962). (In Italian)

Investigations were made on the total lipemia, serum lipoproteins, and cholesterolemic fractions before and after irradiation in 19 patients treated with radiotherapy for malignant tumors. There were no significant changes (as compared to normal values) of total lipemia and cholesterolemic fractions after irradiation. Conversely, the study of lipoproteins electrophoresis showed an increase of the beta/alpha lipoprotein relationship in 16 out of 19 patients. An interpretation of this finding was attempted. (auth)

7873 COMPARATIVE STUDIES OF PROTEIN SERUMS AND TESTS WITH SERUM LABILITY IN RADIATION THERAPY. S. Greco, G. Lombardo, M. Scaccianoce, and F. Spina (Università, Catania, Italy). Radiobiol. Latina, 5: 71-9(Jan.-Mar. 1962). (In Italian)

A comparison was made between electrophoretic research on serum proteins and tests of eucolloidity of the serum based on serum lability in patients suffering from tumors before and after radiotherapy. The changes found were extremely variable and showed no relation either to the extension and severity of the different tumors studied, the dosage received by the patient, or the course of the disease with relation to irradiation. (auth)

7874 STUDY OF THE HEMATOLOGY MODIFICATION IN TELECOBALT THERAPY. S. Greco, T. Papa, M. Scaccianoce, and F. Spina (Università, Catania, Italy). Radiobiol. Latina, 5: 81-98(Jan.-Mar. 1962). (In Italian)

A statistical investigation was made on the quantitative changes of the elements of the peripheral blood before and after radiation treatment in 200 subjects suffering from malignant tumors treated by telecobalt-therapy. The findings showed a slight fall of the red blood cells accompanied by a considerable decrease of the hemoglobin content and by a fall of platelets, which was evident for tumors where a large volume of tissue had to be irradiated. The response of leukocytes to irradiation was different with relation to the technique employed and thus to the integral dosage and the type of distribution of the dose in the tissues. (auth)

7875 BRANCHED CHAIN REACTIONS OF RADIATION AFTER-EFFECT IN WARM-BLOODED ORGANISM. M. I. Shal'nov. Rol Perekisei i Kisloroda v Nachal'nykh Stadiyakh Radiobiol. Effekta, Akad. Nauk SSSR, [Inst. Biol. Fiz.,] 72-84(1960).

A mathematical expression of radiation after-effect is presented as a chain, self-accelerating process. The formulas given enable some parameters of radiation after-effect reactions, such as the dose of half survivability and average time for expectation of radiation death, to be determined. A function is given to describe the radiation spectrum of mice or the spectrum of effective energies of activation of molecular processes in an organism, leading to radiation death after time θ. (Referativnyy zhurnal, Fizika, No. 1, 1962.)

7876 EFFECT OF Co^{60} IRRADIATION UPON UPTAKE OF P^{32} AND I^{131} LABELLED ALBUMIN IN VARIOUS CYTOFRACTIONS. Y. Kasahara and H. Yahashi (Osaka Univ.). Sanfujinka no Shimpo, 13: 311-13(1961).

A study was made of the uptake of P^{32} in liver fragments obtained from adult male mice with Ehrlich's carcinoma implanted into their peritoneal cavities and irradiated with various doses of Co^{60}. I^{131}-labeled albumin in their carcinoma cells was determined. Following Co^{60} irradiation, the nucleic acid metabolism was depressed in the liver cells as well as in the carcinoma cells. The content of the albumin fell most extensively in the microsomal fraction, next in the mitochondrial fraction, and least in the nucleic fraction. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

7877 EXPERIMENTAL STUDIES ON THE INFLUENCE OF X-IRRADIATION ON GLUTATHIONE CONTENT IN ORGANS AND IMPLANTED SARCOMA OF RABBITS. K. Takagi (Kyoto Univ.). Sanfujinka no Shimpo, 13: 315-28 (1961).

Adult male rabbits were exposed to various doses of x irradiation. Regardless of the doses, glutathione content increased in the liver, kidney, and muscle, but did not increase in the lung. In rabbits with Kato's sarcoma implanted in their subcutaneous tissue, glutathione content increased in various organs, and in liver fragments the reduced type of glutathione increased considerably. After x irradiation of the implanted rabbits, glutathione content increased further in various organs except in muscle; in liver fragments, however, the reduced glutathione regained the same level as in normal rabbits. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

7878 CHRONIC GAMMA RADIATION AFFECTS THE DISTRIBUTION OF RADIAL INCREMENT IN PINUS RIGIDA STEMS. G. M. Woodwell and Lee N. Miller (Brookhaven National Lab., Upton, N. Y.). Science, 139: 222-3(Jan. 18, 1963).

Exposure of pitch pine trees to chronic ionizing radiation at rates between 1 and 5 roentgens per day for several years causes reduction of radial increment throughout the stem, the reduction being most pronounced near the base of the tree. Both the size of the tree crown and climate influence the severity of the effect, trees with large crowns showing little effect at low exposures except in years of environmental stress. (auth)

7879 EFFECT OF A CRYSTALLINE ESSENTIAL AMINO ACID PREPARATION ON PATIENTS DURING RADIOTHERAPY. Y. Mori (Osaka Univ.). Sogo Rinsho, 9: 1870(1960).

A crystalline essential amino acid preparation (ES-polytamin) was given to 7 patients with malignant tumors during radiotherapy. The group did not develop leukopenia or thrombocytopenia although a slight to moderate anemia resulted. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

7880 TRANSMISSION AND CROSSING-OVER OF IRRADIATED CHROMOSOMES OF MAIZE. A. Bianchi and M. Contin (Università, Milan). Z. Vererbungslehre, 93: 118-26(1962). (RT/BIO(62)35)

X-irradiated pollen of maize of genotype Yg_2 I Sh Bz Wx were used to fertilize yg_2 C sh bz wx plants. The individuals grown from the heterozygous embryos obtained were backcrossed on and by the multiple recessive yg_2 C sh bz wx stock. Analysis of the different recombination classes led to the conclusion that the treatment was conducive to chromosomes which, although passing through meiosis, show lower transmission as compared with the untreated homologous counterpart, and which tend to undergo crossing-over at a decreased rate, especially in the region Bz-Wx. Both in the treated and untreated material double crossing-over in the region I-Sh-Bz was higher than expected on the basis of the values of the two single crossover rates for the regions I-Sh and Sh-Bz (negative interference). A positive interference was, on the contrary, clear for the region Yg_2-I-Sh, while the segment Sh-Bz-Wx showed no consistent interference. The results are briefly discussed. (auth)

7881 CHANGES IN THE CNS ACTIVITY IN OFFSPRINGS OF IRRADIATED RATS. M. S. Alekseeva (Pavlov Inst. of Physiology, Leningrad). Zh. Vysshei Nervnoi Deyatel'nosti im. I. P. Pavlova, 12: No. 1, 169-72(1962).

Rats of the Wistar line were irradiated with small doses of radioactive Co, and the effect of the irradiation was ex-

amined on three successive generations of their offspring. The method is fully described. It was found that CNS disorders were present in offspring of the second and third generation. The disorders consisted of a decrease of the threshold of the motor analyzer, an increase in the subcortical reflexes, and the appearance of spontaneous epileptoid attacks accompanied by tonic and clonic convulsions. (OTS)

7882 PROGRESS IN RADIATION THERAPY. VOLUME II. Franz Buschke, ed. London, Grune and Stratton, Inc., 1962. 271p. $12.50.

Recent advances in radiation therapy are reviewed. Topics discussed include the clinical and pathological effects of renal irradiation, the significance of the radiosensitivity of the kidney in radiotherapy, the tolerance of cartilage and bone in clinical radiation therapy, developments in the use of Cs^{137} in radiotherapy, periodic fractionation treatment, oxygen as a radiotherapeutic adjuvant, radiation and surgery, the relative place of chemotherapy and radiation therapy, the treatment of Hodgkin's disease, the limitations of histologic diagnosis of malignant diseases, and the place of radiobiology in the training of radiotherapists. (C.H.)

7883 X-IRRADIATION EFFECTS ON THE EARLY MAMMALIAN EMBRYO. R. Rugh. p.218-20 of "IV. International Congress of Neuropathology, Proceedings, Vol. III." H. Jacob, ed. Stuttgart, Georg Thieme Verlag, 1962. (In English)

Exposure of mouse embryos to 15 r x radiation at 0.5 days, prior to the first cleavage of the fertilized egg, resulted in a decrease of 13% in the normal offspring and resulted in an increase from 5.7% to 19% in resorptions and an occasional exencephaly. Exposure to 15 r x radiation at 1.5 days, or the 2-cell stage of development, resulted in 2.3% exencephalies, reduced the percentage of mammals, and increased resorptions, but not as much as when exposure was earlier. Exposure of mouse embryos of 8.5 days to 200 r x radiation resulted in exencephalia in 48% of the fetuses, along with other less graphic effects. It is pointed out that this period in the mouse corresponds to about 3.5 to 4 weeks of age for the human embryo. (C.H.)

7884 REPORT OF THE UNITED NATIONS SCIENTIFIC COMMITTEE ON THE EFFECTS OF ATOMIC RADIATION. GENERAL ASSEMBLY OFFICIAL RECORDS, SEVENTEENTH SESSION, SUPPLEMENT NO. 16 (A/5216). (United Nations. Secretariat). 1962. 446p.

Current information on the effects of radiation on man and his environment is reviewed. Topics discussed include physical and biological aspects of the interactions of ionizing radiation with matter, somatic and genetic effects of radiation, sources of radiation, and a comparison of doses and estimates of risks for each dose level. Pertinent data are appended. (C.H.)

7885 SOME EFFECTS OF NITRIC OXIDE AND OXYGEN ON DOMINANT LETHAL PRODUCTION IN X-IRRADIATED DROSOPHILA VIRILIS MALES. Robert Ross Rinehart. Thesis, Austin, Tex., Univ. of Texas, 1962. 73p.

Drosophila virilis males were treated with various x-ray doses in the presence of small amounts of oxygen, nitric oxide, or a combination of the gases. The effects upon sperm survival were tested at a warm temperature, 23-25°C, and at a cold temperature, 3-5°C. Control experiments were conducted in anoxia and in air at similar x-ray doses and temperatures The treated males were matured for five days and then mated to three heterozygous females for successive two day mating periods. The number of eggs laid each day was recorded. Irradiation damage in Drosophila virilis males was enhanced approximately the same whether 1, 2, or 3% NO was used as the test-gas. This was true at either the 500 or 1000 r level of x radiation. One atmosphere air, at 23-25°C, or 3% O_2, at 3-5°C, showed a similar amount of damage, with similar x-ray doses, as was observed when small amounts of NO were used. A lower temperature did not appear to alter the x-ray damage when the flies were treated with NO or anoxia. However, at 3-5°C irradiation damage was greatly enhanced when 3% O_2 was used as the test-gas. Flies were treated in a mixture of NO, O_2, and NO_2 prepared by mixing 3% NO and 3% O_2. Through hydrolysis of the NO_2, nitric and nitrous acids were presumably formed within the cell. At room temperature the amount of damage under these conditions was intermediate to that observed in the NO tests and tests conducted in anoxia. By lowering the temperature, the amount of damage was increased. The amount of lethality usually associated with 2 or 3% NO and 500 r was decreased if, immediately after irradiation in NO, the flies were post-treated with 1 atm oxygen. A six day period during which no eggs developed from females mated with Drosophila virilis males treated with 3% NO was due to a lack of mature sperm rather than to complete lethality. No definite conclusions were reached regarding mechanisms of enhancement of x irradiation damage in Drosophila virilis males by NO. A number of experiments are pointed out that might resolve more completely the mode or modes of action of NO in the system. (Dissertation Abstr., 23: No. 5, Nov. 1962.)

7886 THE INDUCTION OF DOMINANT LETHAL MUTATIONS IN X-IRRADIATED DROSOPHILA VIRILIS OOCYTES. Richard Curtis Dickerman. Thesis, Austin, Tex., Univ. of Texas, 1962. 70p.

To study the effect of various gases and combinations of gases on the induction of dominant lethal mutations in x irradiated Drosophila virilis oocytes two stages of oocytes were used. Females containing stage 7 oocytes were irradiated with 2000 r and females containing stage 14 oocytes were irradiated with 250 r. The flies were irradiated in the presence of 1 or 10 atm of argon, helium, methane, carbon monoxide, air, oxygen, or combinations of 9 atm of argon, helium, or methane plus 1 atm of oxygen. The percentage non-hatch was attributed to the induction of dominant lethal mutations. It was found that the LD_{50} of mature Drosophila virilis oocytes (stage 14) irradiated in air is about 350 r while the LD_{50} for stage 7 oocytes irradiated in air is about 2000 r. This demonstrated that stage 14 oocytes are much more sensitive to radiation damage than stage 7. Stages 7 or 14 Drosophila virilis oocytes were irradiated in conditions of increased oxygen tension (10 atm air, 1 or 10 atm of oxygen). The groups showed an increased induction of dominant lethals as scored by percentage non-hatch, when compared to oocytes irradiated in one atmosphere of air. Stage 7 or 14 Drosophila virilis oocytes irradiated in the presence of 9 atm of argon, helium, or methane with 1 atm of oxygen showed a large decrease in induced dominant lethals when compared to oocytes irradiated in 1 atm of pure oxygen. This demonstrates that argon, helium, and methane have a protective effect against the induction of dominant lethal mutations. Stage 7 or 14 Drosophila virilis oocytes irradiated in the absence of oxygen (presence of 1 or 10 atm of argon, helium, methane, or carbon monoxide) showed a large decrease in the induction of dominant lethal mutations when compared to oocytes irradiated in 1 atm of air, thus showing that decreased oxygen in the oocyte leads to decreased damage to the cell. Fewer dominant lethals were induced when the oocytes were irradiated in 10 atm of ar-

gon, helium, methane, or carbon monoxide as compared to oocytes irradiated in one atmosphere of the same gas. In preliminary investigations stage 7 Drosophila virilis oocytes were irradiated in the presence of 10 atm of carbon monoxide with fractionated doses. A slight increase in the percentage hatch of the groups irradiated in two fractions as compared to the groups irradiated in one dose was observed. The differences in percentage hatch of the groups irradiated in fractionated doses were not statistically significant. Tentative evidence was presented that indicates that anoxia during fractionated doses or irradiation in stage 7 oocytes does not increase the frequency of induced dominant lethal mutations. (Dissertation Abstr., 23: No. 5, Nov. 1962)

7887 EFFECTS OF IRRADIATION ON GENETICALLY COADAPTED SYSTEMS. Abd El-Khalek Moustafa Mourad. Thesis, New York, Columbia Univ., 1962. 42p.

Experimental populations of Drosophila pseudoobscura kept in laboratory population cages, were used to study the effects of exposure to ionizing radiation. The populations were polymorphic for AR and CH gene arrangements in the third chromosomes. Only AR, or only CH chromosomes, were exposed to radiation. Since the gene arrangements were recognizable cytologically, it was possible to follow the destinies of the irradiated and the non-irradiated third chromosomes in the populations. Control experimental populations, with no radiation histories, were also studied. In populations Nos. 2 and 3, flies carrying the AR chromosomes of the foundation stock were exposed to 16000 r-units of x rays, and the populations were allowed to breed without further irradiation. The frequencies of AR chromosomes declined at first, but subsequently recovered, and in one of the populations almost reached the same equilibrium state as in the control. In populations Nos. 4 and 5, the CH chromosomes of the foundation stock received 12000 r-units, and no further radiation was applied. The frequencies of CH chromosomes declined more rapidly than in the control. In populations Nos. 8 and 9, flies carrying the AR chromosomes were treated with 16000 r of x rays, and thereafter the populations received in every generation an inflow of AR chromosomes exposed to the same amount of radiation. Compared to the controls, the frequencies of AR chromosomes were depressed, but the polymorphism was nevertheless preserved. (Dissertation Abstr., 23: No. 5, Nov. 1962)

7888 WORKS OF THE INSTITUTE OF HIGHER NERVOUS ACTIVITY. Translation by M. Roublev and S. Shoshan of Tr. Inst. Vysshei Nervnoi Deyatel'nosti, Ser. Patofiziol., 4: (1958). 256p. (OTS-61-31021; PST Cat. No. 536). $2.50(OTS).

Seventeen articles are included; separate abstracts were prepared for each. (P.C.H.)

7889 BASIC TRENDS IN RADIOBIOLOGICAL STUDIES IN THE INSTITUTE OF HIGHER NERVOUS ACTIVITY OF THE ACADEMY OF SCIENCES OF THE USSR. I. A. Piontkovskii. p.1-9 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

A review is given on studies of radiation effects on higher parts of the central nervous system. Discussion is given on the types of radiations used, animals on which experiments were performed, and the general aims of the experiments. In most of the investigations only gamma radiation was used. For technical reasons, it was possible to subject only small animals to total irradiation (rats, guinea pigs, rabbits), while dogs, for instance, received local irradiation (usually of the head). It was concluded that one of the factors in the development of disorders in higher nervous activity following the effect of radiation is a cortical cellular hypoxia. (P.C.H.)

7890 CHANGES IN MOTOR ALIMENTARY CONDITIONED REFLEXES OF WHITE RATS UNDER THE EFFECT OF LOCAL GAMMA-IRRADIATIONS (Co^{60}). V. E. Miklashevskii. p.10-24 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Marked disorders in previously elaborated motor alimentary conditioned reflexes were observed following a single irradiation of white rats by gamma rays (Co^{60}) with a dose of 650 r, indicating the spread of protective inhibition in the cerebral cortex. This was noted during the first hours following irradiation, or at the end of the first day. Sometimes it was found to set in on the second day of the post-radiation period, preceded in this case by a transient cortical hyperexcitability. The experimental groups with various local exposures to radiation were distributed in the following sequence according to the rapidity of development and degree of severity of these disorders: S–irradiation of the trunk, the head being shielded; T–total body irradiation, C–local irradiation of the head; A–local irradiation of the abdominal region (the first group being least affected and the last, the one most affected). The two first groups were characterized by a marked weakening of active inhibition and corresponding increase in cerebral cortical excitability (disinhibition of differentiations and hypnotic phasic states); the last two groups exhibited a clear predominance of diffuse cortical inhibition over all other forms of disorders of conditioned-reflex activity, the intensity of inhibition differing in the two groups. The development and course of disorders of alimentary conditioned reflexes over a period of 55–60 days following irradiation were divided into three stages. The stages in the case of the rats of groups S and T were in the following order: I-stage of initial changes, II-stage of pronounced (maximal) disorders, III-stage of intermittent recovery; a distinctive shift to the left was characteristic for groups C and A (I-stage of maximal disorders, II-stage of intermittent recovery) with stage III being one intermittent depression and recovery. (auth)

7891 EFFECT OF DAMAGING DOSES OF GAMMA-RADIATION ON UNCONDITIONED AND CONDITIONED RESPIRATORY REFLEXES. F. Z. Meerson. p.25-41 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Following total gamma irradiation with a dose of 1500 r (dose rate of 4 r per minute), radiation injury developed in rabbits, accompanied by characteristic blood changes, loss of weight, trophic changes, hypotonia, and slowing of respiration. The process ended with the animal's recovery. Irradiation with a lethal dose of 5000 r, also brought about coronary blood circulatory disturbances, extrasystoles, and locomotor disorders. Respiratory unconditioned reflexes recorded first in normal rabbits and then in the same animals with radiation injury showed that reflex activity changes after irradiation. The duration of reflex apnea brought about by stimulation of the exteroceptors of the trigeminal nerve with ammonia vapor increased 1.5-2 times. Stimulation of the propioceptors of the carotid sinus with a minimal dose of lobeline injected intravenously caused only a slowing down of respiration in non-irradiated, and a reflex apnea in irradiated animals. The longer duration of reflex apnea during radiation injury may be ascribed to the decrease in functional sensitivity of the respiratory center, since the duration and the extent of inhibition brought about in the nerve center by the strong stimulus was greater, all other conditions being equal, the lower its

functional sensitivity before stimulation. The fact that hypoxia due to various causes increased the resistance of animals to radiation injury may indicate that decrease in functional sensitivity of the respiratory center and slowing down of respiration observed during radiation sickness are not only due to radiation injury, but are to some extent also a physiological measure of protection of the organism against the injury. In the course of the first 3-4 days after total gamma irradiation with a dose of 1500 r (dose rate 4 r per minute) cortical supraliminal inhibition was observed, manifested by the disappearance of conditioned reflexes, a decrease in their intensities, and appearance of phasic states (narcotic and equalizing phases). The decrease or total disappearance of conditioned-reflex apnea observed after gamma irradiation was combined with a marked increase in the unconditioned-reflex apnea. Thus, despite depression of the respiratory center, despite its increased tendency to inhibition, the cortex damaged by radiation temporarily loses its inherent capacity of inhibiting the rhythmic activity of the center. (auth)

7892 EFFECT OF GAMMA RAYS ON HIGHER NERVOUS ACTIVITY OF DOGS. L. N. Khruleva. p.42-60 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Relatively small doses of ionizing radiation (50 r) brought about changes in higher nervous activity of dogs. The character of the changes differed in animals with different types of nervous activity. In an animal with a strong unbalanced type of nervous system, a gamma dose of 50 r brought about a bi-phasic change consisting of an initial short-lasting decrease in conditioned reflex intensities, followed by a prolonged period in which they increased. In an animal with an intermediate type of nervous system nearer to the strong type, in which excitatory states predominate over inhibitory ones, the changes in higher nervous activity also had a bi-phasic character, but the first phase was often less marked and accompanied by various nervous activity disorders, while the conditioned reflex intensity increase in the second phase was less marked than in an animal of the strong type. In an animal of the weak type, small doses of gamma rays brought about a serious higher nervous activity disorder, which resulted in prolonged neurosis. (auth)

7893 EFFECT OF GAMMA-IRRADIATION ON THE COURSE OF CONDITIONED SECRETORY-MOTOR ALIMENTARY REFLEXES IN DOGS. N. G. Ivanova. p.61-72 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

The cerebral cortex of dogs was sensitive to relatively small doses (50 r) of gamma rays. Repeated irradiations at regular time intervals brought about marked and persistent changes in the animals' higher nervous activity. The functional state of the nerve cells changes under the influence of penetrating radiation, and the change is expressed as an imbalance of excitatory and inhibitory processes and by the weakening of active inhibition. A comparison of rate of onset of the changes, their extent and duration of effect on the secretory and motor reflexes, made it possible to infer that the motor zone of the cortex is more sensitive to gamma rays than the alimentary center. The character of conditioned reflex activity alteration and its recovery rate depend on the animal's type of higher nervous activity. (auth)

7894 EFFECT OF LOCAL IRRADIATION OF THE CORTICAL COMPONENT OF THE VISUAL ANALYSOR IN RABBITS ON MOTOR DEFENSE REFLEXES ELABORATED WITH VISUAL STIMULI. R. M. Meshcherskii. p.73-81 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

The local action of ionizing radiation on the cortical component of the visual analyzer affected the intensities of conditioned motor reflexes and of intersignal reactions arising after the application of various combinations of stimuli. Immediately after exposure to a dose of 200 r, an increase in cortical excitability, expressed by the intensification of positive reflexes, disinhibition of differentiations, and intensification of intersignal reactions was observed. Conditioned reflexes were strong on the following days and a localization of their motor effector component was noted, as well as the development of delayed inhibition, which may be accompanied by the intensification of differentiating inhibition. (auth)

7895 IMPORTANCE OF ANIMAL NERVOUS SYSTEM TYPE IN THE DEVELOPMENT AND REGRESSION OF CHANGES IN HIGHER NERVOUS ACTIVITY FOLLOWING IRRADIATION. L. I. Kotlyarevskii, L. S. Gorsheleva, and L. E. Khozak. p.82-8 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

The effects of x irradiation with a 50 r dose on the development and regression of changes in higher nervous activity in rats were studied. Correlations were made between animal types and disorders brought about in their higher nervous activity following irradiation. In the period following irradiation, or in artificially induced infections following the injection of diphtherial or staphylococcal toxins with nervous activity in a normal state, the disease processes in animals previously subjected to similar irradiations had a severe and more prolonged course in animals of the weak type. Judged by the duration and degree of severity of disorders in higher nervous activity, animals with irritable type nervous systems were closer to the weak type, although the character and course of disorders in the two types were not identical. In contrast, the course of development and regression of activity disorders of the higher parts of the central nervous system in animals of the strong balanced type were less severe and more rapid. (P.C.H.)

7896 DISORDERS IN THE TRACE AND SIMULTANEOUS CONDITIONED REFLEX SYSTEMS BROUGHT ABOUT BY THE ACTION OF IONIZING RADIATION ON WHITE RATS. L. S. Gorsheleva. p.89-109 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Total irradiation with an x-ray dose of 50 r caused in most animals a state of cortical hyperexcitation, as well as disorders of active inhibition observed early after irradiation, expressed as a disinhibition of the first phase of trace conditioned reflexes. Successive inhibition and disinhibition of differentiation later set in. A second irradiation with the same dose resulted in a similar disordered activity. Conditioned reflexes did not return to normal after an interruption of one week between exposures. Conditioned reflexes became weaker and later disappeared completely in the first stage following each of the three irradiations (single dose 50 r). In the second stage of the post-irradiation period, cortical excitability again increased, at first fluctuating but later acquiring a steady and sustained character. The third post-irradiation period was characterized by a gradual return to normal of conditioned-reflex activity. There was a certain correlation between changes in the trace conditioned reflex following x irradiation and the type of nervous system to which the animal belonged. During the period of increased cortical excitability, the trace conditioned reflexes in representatives of a strong balanced type of nervous system became temporarily transformed

into simultaneous reflexes; they lose their inhibitory phase. When cortical excitability decreased, they either showed a marked decrease in intensity or disappeared. In animals of the irritable type, a persistance of conditioned trace reflexes on a background of marked decrease in cortical excitation, as well as the appearance of an ultraparadoxical phase, were noted in addition to the other changes. In animals of the weak type, changes of inhibitory nature predominated. The trace conditioned reflex was usually the last to return to normal. With repeated irradiations, the disorders in the artificial conditioned reflexes became more severe. Disorders in the natural conditioned reflex were observed only after carrying out a second series of three irradiations. Thus, the cumulative effect of repeated irradiations is of great importance in the pattern of changes in conditioned reflex activity following x irradiation. (auth)

7897 EFFECT OF REPEATED X-RAY IRRADIATION ON HIGHER NERVOUS ACTIVITY IN ANIMALS (WHITE RATS). L. E. Khozak. p.110-28 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Total x irradiation of animals with a single dose of 50 r resulted in noticeable disorders of higher nervous activity in the form of a short-lasting increase of excitation and weakening of active internal inhibition in most cases. There was no change in the animals' general behavior. After a second irradiation with the same dose of 50 r, most animals showed an increased excitation, and in addition, exhibited disorders of normal strength relationships of conditioned stimuli, the process of active inhibition changing only little. A generalized motor excitation marked the animals' behavior at this stage. A third irradiation resulted in more pronounced changes in function of the higher parts of the central nervous system: the increased excitatory state, together with phasic manifestations of high degree which set in on the first or later days after irradiation, in most cases became steady and marked; at the same time, internal inhibition weakened in some animals, and in others showed no change. Towards the end of the three month observation period, higher nervous activity almost returned to normal. Subsequent irradiations, mainly the 5th and 6th, but also the 7th, generally resulted in the weakening of positive conditioned reflexes, in disorders of strength relationships, weakening of active inhibition, and manifestations of cortical exhaustibility. In this period, the animals' general behavior was characterized by a decrease in motor excitation. The character of the changes in conditioned reflex activity, as well as that of the general behavior, depended on the type of nervous system to which the animal belonged. (auth)

7898 EFFECT OF INJECTION OF STAPHYLOCOCCAL TOXIN ON ACTIVE AND TRACE CONDITIONED REFLEXES IN PREVIOUSLY IRRADIATED WHITE RATS. L. S. Gorsheleva. p.129-48 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Injection of staphylococcal toxin, with a dose of 2 ml per 1 kg of body weight, into animals in which conditioned reflex activity was in a state of partial recovery from a triple total x irradiation with a single dose of 50 r, resulted in more severe disorders of higher nervous activity than injection of the same toxin dose into animals with normal conditioned reflex activity patterns. The severity of the disorders was seen in the rapid onset and protracted course of diffuse supraliminal cortical inhibition which also involved the subcortical regions, by the prevalence of paradoxical and ultraparadoxical phases and by the persistence of disorders in conditioned reflex activity, particularly of the trace conditioned reflex, during the entire period of study. The severe course of disorders in higher nervous activity observed in animals subjected to the action of toxin when conditioned reflex activity was partially recovered after irradiation, indicated that cerebral activity in the animals was evidently already considerably affected by irradiation at the time of toxin administration. (auth)

7899 EFFECT OF DIPHTHERIA TOXIN ON THE ACTIVITY OF THE HIGHER PARTS OF THE CENTRAL NERVOUS SYSTEM IN ANIMALS (WHITE RATS) PREVIOUSLY SUBJECTED TO X-RAY IRRADIATION. L. E. Khozak. p.149-71 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

A single injection of diphtheria toxin led to prolonged disorders in the activity of the higher parts of the central nervous system in animals previously subjected to x irradiation. The disorders are expressed in the form of three consecutively developing stages. An initial inhibitory stage, which set in from the first hours after injecting the toxin, led to the disappearance first of artificial conditioned reflexes, then to the loss of natural conditioned reflexes, and then to the loss of sight and smell. In this period the animals' general behavior also changed, they became sluggish and often passed into a semi-somnolent state. The second stage was characterized by recovery first of natural alimentary conditioned reflexes, and later of artificial reflexes, the latter being extremely unstable. Stable phasic manifestations developed on this background, mainly in the form of paradoxical and ultraparadoxical phases. A third stage was marked by a relative normalization of conditioned-reflex activity, but which, in some animals, did not last for more than 1-2 days; in other animals normalization of higher nervous activity did not occur. (auth)

7900 SOME DISORDERS IN HIGHER NERVOUS ACTIVITY OF RATS BORN OF FEMALES EXPOSED DURING PREGNANCY TO GAMMA-RAYS OF RADIOACTIVE COBALT (Co^{60}). I. A. Piontkovskii and I. A. Volodina. p.172-95 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Rats born of mothers irradiated with Co^{60} gamma rays during pregnancy sometimes exhibited skeletal defects and their weight lagged behind that of control animals for a long time. The study of higher nervous activity in adult animals born of females irradiated by gamma rays during pregnancy indicated the presence of various disorders in cerebral function. The fixation of a conditioned reflex to an auditory and visual stimulus took place more slowly in such animals than in controls. The elaboration of differentiation was extremely difficult, and its disinhibition was often observed. The latent period of the conditioned reflex to sound was somewhat shorter, in experimental animals, and the latent period to a visual conditioned stimulus somewhat more prolonged than in control animals. Higher nervous activity of animals born of mothers irradiated during pregnancy was characterized by its instability and by its chaotic fluctuating course, relatively normal conditioned reflex activity alternating with total disappearance of conditioned reflexes. Disorders of strength relationships were often observed, with the appearance of phasic states and supraliminal inhibition. A considerable decrease in the strength of the basic nervous processes – stimulation and inhibition – was observed, and a decrease in the functional ability of the cortical cells. A decrease in mobility of the nervous processes, and a disorder in their balance, with prevalence of excitation, was also observed. The higher nervous activity of ani-

mals born of mothers irradiated during pregnancy exhibited some traits characteristic of wild animals. (auth)

7901 CERTAIN DATA ON THE INFLUENCE OF IONIZING RADIATION ON THE MORPHOLOGY OF THE CENTRAL NERVOUS SYSTEM IN ANIMALS. M. M. Aleksandrovskaya. p.196-208 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

X irradiation brought about reversible morphological changes in the various tissue-structure elements of CNS two hours after total irradiation of the animals with a dose of 50 r. The same changes were detected also on the third day after irradiation. Morphological changes of the same character were brought about in the same period of time by a total dose of 100 r (a double irradiation) and 150 r (a triple irradiation). The morphological changes from a triple irradiation of a total dose of 150 r, became more intense on the seventh day. Stable morphological changes, expressed by edema and vacuolation of the nerve cells, and which involved a considerable number of neurons, were detected after thirty days. Morphological changes were already distinct after the fifth irradiation with a total dose of 250 r and after the seventh irradiation with a total dose of 350 r, both 7 and 30 days following irradiation. The vascular changes following the first, second, and third irradiations consisted in changes of capillary tonus; following the fifth irradiation with a total dose of 250 r, and the seventh irradiation with a total dose of 350 r, the vascular changes were expressed by more severe hemodynamic disorders, perivascular edema, plasmorrhages, and disturbances in the permeability of the vessel walls in the form of scattered diapedetic hemorrhages. There are no changes in glial reactions following a total single or double irradiation. After 3, 5, and 7 irradiations, the glia showed dystrophic changes, without cellular hyperplasia or hypertrophy; a focal accumulation of microglia in the white matter and a breakdown and fragmentation of the dendrites in certain areas were also noted. Hyperplasia of the oligodendroglia with swelling of the compact forms and a marked branching of the cells occurred. Damage associated with oxygen deficiency in the brain was expressed by the presence of hyalin thrombi in the blood vessels and by the appearance of a central tinctorial acidophilia of the nerve cells, and was apparently associated with the damage caused to enzymatic-oxidative processes in the brain tissue. It is assumed that there is not only an indirect influence on the nerve cells of the brain via the vessels but apparently also a direct influence of radiation energy on the parenchyma of the brain. The assumption is based on the fact that the vascular changes are considerably less marked with these doses than the changes in the nerve cells. (auth)

7902 HISTOPATHOLOGICAL CHANGES IN THE CENTRAL NERVOUS SYSTEM FOLLOWING TOXIN ADMINISTRATION AND INFECTIONS IN ANIMALS PREVIOUSLY IRRADIATED. M. M. Aleksandrovskaya. p.209-19 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

A systematic and prolonged morphological analysis of changes in the CNS in animals subjected to multiple x-ray irradiations with small doses (with total doses of 250 r and 350 r) and with subsequent administration of staphylococcal and diphtherial toxins (on the background of an incomplete recovery of conditioned reflex activity) showed very distinct dystrophic changes in the CNS in the experimental animals as compared with the control animals, which were subjected only to the influence of x rays or only the toxins. Histological examination of animals subjected to the influence of a triple irradiation with a total dose of 150 r and subsequent introduction of 2 ml of staphylococcus toxin showed more severe pathological changes in the brain, which were proportional to the time interval following introduction of the toxin. In irradiated animals, in addition to dystrophic changes in the various tissue-structure elements of the brain, a productive microglial reaction was observed 113 days after the introduction of toxin. Morphological changes after seven irradiations with a total dose of 350 r and subsequent administration of $^1/_{15}$ lethal of diphtheria toxin had a dystrophic character in the cortex, subcortical ganglia and other lower formations of the brain in animals sacrificed 120 days after the toxin administration. Marked metabolic changes, with a total decrease in the amount of RNA and argyrophil granules in the nerve cells, were noted. Anoxic phenomena were found in the cortex and subcortical ganglia of the brain as well as in the cells of the nuclei in the medulla oblongata and cerebellum. Vascular changes consisted of plasmorrhages and diapedetic hemorrhages. The glial reaction had a productive dystrophic character. The morphological changes in the brain and internal organs of white rats after multiple irradiations with small x-ray doses were more marked in the presence of pasteurellosis, which was found during life and confirmed at autopsy, than in non-irradiated animals with pasteurellosis. Edema, vacuolation and nerve cell lysis in this case were generally distributed. The histochemically determined alterations in RNA content were also significant, as were those of argyrophil granules. The general resistance of the organism was lowered in animals previously subjected to multiple irradiations and later infected with diphtherial and staphylococcal toxins. Reactions to pasteurellosis infection were also more severe. Thus, in the case of irradiation injury the course of both toxic and infective processes was unusual. The non-reactivation of microglia, which is characteristic for small x-ray doses, was altered into a specific reactivity. This consisted of the acute proliferation of mesenchymal cells particularly in the parts of the brain where damage to nerve cells and fibers was most marked, and also in the unusual focal microglial reactions in the white matter. (auth)

7903 EFFECT OF LOCAL SINGLE IRRADIATION OF RABBIT BRAIN ON ITS MORPHOLOGY. N. I. Artyukhina. p.220-33 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

A single exposure of the brain of rabbits to a radiation dose of 5000 r, while shielding the rest of the body, caused the development of a diffuse pathological process in the brain. Following application of the 5000 r dose of ionizing radiation, vascular disorders appeared in the form of disorders of permeability of the vascular walls (edema, plasmorrhagia), swelling of the endothelium, and proliferative reactions around the vessels and hemorrhages. Morphological studies of the nerve cells revealed changes in them, as in the other elements of the CNS. Use of the histochemical method for the detection of RNA revealed a series of consecutive disorders in the RNA content of cells. Changes in the argyrophil granules generally paralleled those of RNA contents. It was assumed that the dystrophic changes in the nerve cells of rabbits were the result of both a primary influence and a secondary reaction of the CNS to the local action of the ionizing radiation. In the nerve fibers, marked changes were seen only on the 7th and 14th days after irradiation of the rabbits. The glial reactions had a productive character, with elements slightly dystrophic. The reaction of the astrocytes appeared 24 hours after irradiation in the form of proliferation of cells around the vessels. Marked hyperplasia of the microglial cells was noted on the third day after irradiation. The oligodendroglia appeared in the

form of compact swollen and drainage cells, which can be explained by the well-marked edematous condition of the brain. Insignificant changes appeared in the internal organs following local action of the ionizing radiation. On the 7th and 14th days, signs of slight cloudy swelling and hydropic degeneration, as well as few punctate hemorrhages were seen in the liver and kidneys. Changes in the internal organs were considered to be of a secondary character. (auth)

7904 HISTOPATHOLOGICAL CHANGES IN THE CNS AND IN THE INTERNAL ORGANS OF WHITE RATS FOLLOWING IRRADIATION OF THE BRAIN WITH VARYING DOSES. N. I. Artyukhina. p.234-46 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

A severe pathological process, which was characterized by changes in the vessels, hemorrhages, diffuse damage to nerve cells and fibers, and by dystrophic changes in the glial elements, was found by histological examination of the brains of irradiated rats. In the internal organs, the main changes consisted of an atrophy of the splenic lymphatic tissue. In animals irradiated with doses of 1950, 1300, and 650 r, and which were sacrificed at the same period after irradiation, similar and dissimilar morphological changes were noted at the same time. Histological examination showed that the nerve cells of the 5th cortical layer, of the globus pallidus, putamen, subthalamic nuclei, hypothalamus, 9th and 10th cranial nerve nuclei, and substantia reticularis of the medulla oblongata were damaged the most. The nerve fibers as well as the vessels in the brain were comparatively little damaged. Glial reactions in rats were mainly of dystrophic character and were more marked in animals irradiated with doses of 1950 and 1300 r than in animals irradiated with a dose of 650 r. Histological examination of the brain revealed a parallel between the RNA reaction and changes in argyrophil granulation. The only changes found in the internal organs during the first week after irradiation were in the spleen, consisting of atrophy of the lymph follicles. (auth)

7905 CERTAIN CHANGES IN PROTEIN METABOLISM OF THE BRAIN FOLLOWING IRRADIATION WITH GAMMA-RAYS OF Co^{60}. First Communication. M. S. Osipova. p.247-52 of "Works of the Institute of Higher Nervous Activity." OTS-61-31021; PST Cat. No. 536.

Investigations were made on the activity of proteolytic enzymes in the brain tissues of animals in relation to irradiation doses and time interval after irradiation. The activity of proteolytic enzymes (proteases) in the tissues of the various parts of the brain was decreased following total irradiation of white rats with small doses (50 r during 7 days) and following the irradiation of the head of rabbits with large doses (2000 r), 20 minutes after irradiation. An increase in proteolysis was observed 1.5 hours after the irradiation of the head of rabbits with a dose of 2000 r. Proteolysis increased in guinea pigs after a total single irradiation with doses of 1500-2000 r, 20 minutes after irradiation. Data obtained from the investigation of swelling of tissues in various parts of the brain of irradiated animals showed that the ability of the brain for swelling was increased 20 minutes after irradiation of the head of rabbits with a dose of 2000 r. (auth)

Radiation Sickness

7906 (BNL-6018) PATHOGENESIS AND REGENERATION OF RADIATION INDUCED BONE MARROW INJURY, AND THERAPEUTIC IMPLICATIONS. T. M. Fliedner, E. P. Cronkite, and V. P. Bond (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT-30-2-GEN-16]. 34p.

The hematological data of patients of 4 radiation accidents, Rongelap 1954, Oak Ridge 1958, Vinca 1958, and Lockport 1960, are reviewed and compared. The blood cell curves appear to show three phases. An initial phase at about 8 to 10 days, a phase of transient or abortive regenerations, and a phase of final effective recovery were demonstrated. These phases in the blood are preceded and caused by particular events in the bone marrow. Evidence was brought forward that transient rises in leukocytes and reticulocytes associated with a delayed platelet disappearance curve are associated with a marrow capable of spontaneous recovery. In patients with inhomogenous total-body irradiation, the transient rise may lead directly to effective recovery. Immediate decline of all blood cell elements without evidence of further, even abortive attempts of marrow regeneration must be considered as evidence for a lethal bone marrow dose and extremely serious complications may be expected. The clinical implications of these analyses are outlined and the diagnostic possibilities described. (auth)

7907 OXYGEN AND DOSE-RATE EFFECTS ON SURVIVAL CURVES OF γ-IRRADIATED TRANSFORMING DNA IN THE PRESENCE OF PROTECTIVE SUBSTANCES. R. Pakuła, W. Walczak, and D. Shugar (State Inst. of Hygiene, Warsaw). Acta Biochim. Polon. (English Transl.), 9: 227-37(1962).

A study was made of the inactivation of streptococcal transforming DNA by ionizing radiations in dilute aqueous medium, and the protection conferred by the presence of various substances. A rather high degree of specific protection prevails in the presence of thiourea and some mercaptans. In the presence of the -SH compounds there is a pronounced oxygen effect. An appreciable dose-rate effect also manifests itself in the presence of the -SH compounds, but not with thiourea, yeast extract, ribonucleic acid, or hyaluronic acid. The survival curves for different DNA preparations exhibit some variation in the $D_{37\%}$ dose which is, in part at least, dependent on the protein content of the transforming DNA sample. It is essential to use the same preparation throughout any given series of experiments in order to obtain comparable results. (auth)

7908 THE EFFECT OF PHYSICAL EXERCISE ON THE LEVELS OF GLUCOSE, PYRUVIC ACID, LACTIC ACID, CHOLESTEROL, AND PHOSPHOLIPIDS IN THE BLOOD OF RADIATION-SICK RATS. Lech Markiewicz. Acta Physiol. Polon., 13: 467-76(July-Aug. 1962). (In Polish)

In experiments on rats given physical exercise before irradiation the behavior of pyruvic acid, lactic acid, glucose, cholesterol, and phospholipids in the blood was investigated. The rats received doses of 700 r on the entire body. Before being irradiated, some of the animals were running on a mechanical runway daily over a period of 30 days for successively longer periods. Without the training, irradiation raised the blood glucose level considerably; having reached maximum after 24 hours, it gradually fell, to become after 14 days lower than in controls. The lactic acid-level, on the other hand, showed consistently an upward trend. There were no statistically significant changes in the levels of pyruvic acid and cholesterol. When irradiations was preceded by systematic physical exercise, the decline of these compounds was much milder. The level of pyruvic acid rose considerably. Beginning with the 10th day after irradiation, the lactic acid-level declined in comparison with

that of the untrained group. From the 5th day onwards, the level of cholesterol also fell considerably. Moderate physical exercise appears to mitigate changes caused by irradiation. The possible mechanism is discussed. (auth)

7909 REACTIVITY TO CHLORPROMAZINE IN ACUTE RADIATION SICKNESS. Andrzej Danysz and Tadeusz Żaczek. Acta Physiol. Polon., 13: 477-82(July-Aug. 1962). (In Polish)

The effect of x ray irradiation on reactivity to chlorpromazine was investigated in albino rats. In acute radiation sickness the conditional reflex-inhibiting and stress-relieving action of chlorpromazine was notably stronger. It is concluded that the intensified central action of chlorpromazine may be due to a rise in the brain acetylcholine level after irradiation. (auth)

7910 ACTION OF X RAYS ON HEMIN. H. Gomes Oliveira, M. L. Beaumirage, C. Cuvelier, W. Notay, and G. Barac (Université, Liège). Arch. Intern. Pharmacodyn., 131: 236-8(1961). (In French)

Protein-free solutions of hemin were irradiated with soft x rays (50 kv) at a dose rate of 2065 r/sec. Various radioprotective agents were added to the solutions, which were buffered at pH 7.35 or 13.33, and the percentage of hemin recoverable after irradiation was determined. Destruction of hemin was detected at doses above 50 kr and was 80 to 85% complete at 0.5 to 1 Mr. Destruction was greater at pH 7.35 than at 13.33. In the presence of radioprotective agents at concentrations of 3×10^{-3} M the percentage destruction of hemin at 0.5 Mr was as follows: ascorbic acid 30%, cystine 60%, cysteine 70%, cystamine 75%, and cysteamine 80%, compared with 85% in their absence. The presence of plasma, bovine serum albumin, or globin almost completely prevented breakdown of hemin during irradiation. H_2S formed during the irradiation of cysteine was shown to react with hemin. It is suggested that radiation, as do oxidizing agents, split hemin into 2 fragments. (H.H.D.)

7911 THERAPY OF HYPOPLASTIC ANEMIA WITH BONE MARROW TRANSPLANTATION. William McFarland, Norma Granville, Robert Schwartz, Herman Oliner, D. K. Misra, and William Dameshek (Tufts Univ., Medford, Mass.). Arch. Internal Med., 108: 23-33(July 1961).

Twenty cases of aplastic anemia were treated with infusions of homologous bone marrow, and their course compared with the results obtained in 17 patients treated with measures other than marrow infusions. No differences in the overall survival were found between the group treated with bone marrow and the control group. Splenectomy had no discernible, statistical effect on the survival of either group, but there were 3 cases in which a dramatic effect took place following splenectomy which was done about 2 weeks after bone marrow transplantation; thus the role of the spleen in the acceptance of a marrow graft remains uncertain. Patients who received marrow from closely related donors appeared to respond significantly better than those who received marrow obtained from unrelated donors. The dose of marrow cells and route of administration (intravenously or directly into the medullary cavity) seemed unrelated to eventual recovery in the treated group. The use of high doses of corticosteroids, in an attempt to allay the homograft reaction, represented a genuine hazard to the leukopenic, aplastic patient with respect to the incidence of fatal infection. Certain patients treated with bone marrow infusions derived both immediate, objective hematologic effects and sustained benefits from the treatment. Some of these patients are apparently cured. The mechanisms of the immediate salutary effects occurring in some cases following bone marrow infusions are obscure. Although the value of bone marrow infusions in the treatment of hypoplastic anemia is uncertain, sufficient indications of possible benefit are present to warrant continuation of the study. More exact data are particularly needed with respect to actual, although temporary, bone marrow transplantation, and the combined effects of marrow infusion and splenectomy. (auth)

7912 CHEMICAL RADIATION PROTECTION. R. Koch, H. Langendorff, and H.-J. Melching (Universität, Freiburg i. B.). Chemotherapia, 3: 153-75(1961). (In German)

Historical aspects of the development of radioprotective agents are discussed and the action of various types of agents (sulfhydryl compounds, biogenic amines, alkaloids, and vitamins) are reviewed. Their modes of action and interactions with metabolic processes are also considered. 153 references are cited. (H.H.D.)

7913 EFFECT OF NUCLEOSIDE DERIVATIVES OF RIBONUCLEIC ACID ON THE SURVIVAL OF RATS EXPOSED TO WHOLE-BODY IRRADIATION IN A SINGLE DOSE. M. Magistretti, F. Bellini, A. Majoni, and D. Pacillo (Università, Milan). Minerva Nucleare, 6: 216-19(July-Aug. 1962). (In Italian)

The effect of a mixture of ribonucleosides (adenosine + guanosine + uridin + cytidin) on the mortality of rats totally irradiated with a single 680 r unit dose was investigated. A statistically significant difference was observed between the survival curve of animals treated with the nucleoside mixture immediately after irradiation and the curve observed in the controls. In fact, the survival rate 14 days after irradiation was 40% in the treated group, whereas a 95% mortality rate was observed in the control group. The body weight also showed a different behavior in the two groups. After a rapid initial loss of weight, the initial values were not restored in the control group, whereas in the animals treated with the nucleoside mixture a gradual, marked increase in body weight was observed; in this group the weight was 35% greater at the end of the period of observation than initially. (auth)

7914 FIRST OBSERVATIONS ON THE RADIATION PROTECTION EFFECT OF PANTOTHENIC ACID. I. Szórády, Gy. Tóth, and I. Gazdag (Szeged). Naturwissenschaften, 49: 452(1962). (In German)

The radioprotective effect of pantothenic acid, in the form of the calcium salt, was examined in white mice receiving subcutaneous injections of 0.5 mg for 7 days. In addition to the control group, which received no pantothenic acid, but which were exposed to whole-body x irradiation, one group received pantothenic acid for one week, and then after a week's interval x irradiation. A second group received pantothenic acid for one week and then were immediately exposed to x radiation. A third group received the pantothenic acid for one week immediately after x irradiation. The survival rate for 30 days was determined, and the results show that the first group had the best survival rate. Pantothenic acid received after irradiation has no effect on survival. The processes responsible for the radioprotective effect of the acid were discussed. (J.S.R.)

7915 ACUTE RADIATION SICKNESS. Marshall G. Nims. Rocky Mt. Med. J., 58: 26-7(Dec. 1961).

Symptoms of radiation disease developing in humans at various radiation doses are discussed. (H.H.D.)

7916 PROLONGED STORAGE OF MARROW AND ITS USE IN THE TREATMENT OF RADIATION INJURY. E. D. Thomas and J. W. Ferrebee (Columbia Univ., Cooperstown, N. Y.). Transfusion, 2: No. 2, 115-17(Mar.-Apr. 1962).

Marrow was removed from the femurs of dogs and frozen in 15% glycerol at 1°C per minute. Marrow from one dog was stored at −80°C and from the other at −180°C for a period of 14 months. Each dog was then given 1200 r of whole-body irradiation followed by infusion of his own thawed marrow. Recovery was rapid, and the dogs were living and well two months later. (auth)

7917 PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON BONE MARROW THERAPY AND CHEMICAL PROTECTION IN IRRADIATED PRIMATES, AUGUST 15-18, 1962, RIJSWIJK (Z. H.), THE NETHERLANDS. Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962. 458p. Dlfs. 15. Also available from Univ. of Tennessee, Memphis for $4.00.

A symposium on bone marrow therapy and chemical protection in irradiated primates was held at Rijswijk (Z. H.), The Netherlands, on August 15 to 18, 1962. Separate abstracts have been prepared on 20 papers presented at this meeting. (C.H.)

7918 BONE MARROW TRANSPLANTATION IN THE PROTECTION OF PRIMATES AGAINST RADIATION. Clara M. Ambrus, Solange Amos, Bernard Amos, Avery Sandberg, Richard Wang, Erwin Neter, and Julian L. Ambrus (Roswell Park Memorial Inst., Buffalo and Univ. of Buffalo Medical and Graduate Schools). p.27-45 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Autologous bone marrow transplantation appears to be more effective in lethally radiated monkeys than homologous bone marrow transplantation. Significantly higher numbers of homologous marrow cells are required than autologous marrow cells for protection. Platelet and leukocyte counts decreased equally rapidly in control and bone marrow treated animals following lethal doses of radiation. However, control animals died at the depth of pancytopenia while many of the marrow protected animals survived. Injection of a bacterial lipopolysaccharide produces leukocytosis in the marrow treated animals but little or no leukocytosis in control, radiated monkeys. The leukocytosis producing effect of lipopolysaccharides may be a useful tool to determine autologous bone marrow takes. Analysis of immunologic markers indicated that donor type marrow was present in at least some of the radiated recipients. Eventually these animals reverted to the original antigenic types. Possible late disease was observed in only one monkey injected with homologous marrow. (auth)

7919 TRANSFUSION OF HOMOLOGOUS AND AUTOLOGOUS BONE MARROW IN PRIMATES EXPOSED TO 900r WHOLE BODY X-RADIATION. Robert J. Young, Walter H. Whitcomb, George S. Melville, and Donald R. Anderson (School of Aerospace Medicine, Brooks AFB, Tex.). p.47-71 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Twenty rhesus monkeys were irradiated with 900 r x irradiation. Six animals served as irradiated controls, eight were transfused with homologous bone marrow (HBM), and six were transfused with autologous bone marrow (ABM). The serologic difference of the donor and host erythrocytes was used as an indicator to establish definite takes in the HBM hosts. Three of the HBM hosts demonstrated donor erythrocytes in the circulating blood which first appeared seven days posttransfusion. Two of the HBM hosts demonstrated leukocyte and reticulocyte concentrations equal to the above but with no evidence of donor erythrocytes. Three of the HBM hosts expired early, two of which demonstrated hypercellular marrows. Three of the ABM hosts expired without evidence of marrow regeneration and three expired after the 90 day observation period with ulcerative colitis associated with Salmonella B infestations. Animals receiving HBM and ABM had significant leukocyte and reticulocyte concentrations approximately one week before the irradiated control animal. The serum glutamic pyruvic transminase values were markedly elevated in all HBM hosts surviving to the fifteenth day and beyond. A correlation exists between HBM hosts showing donor erythrocytes and their survival time. The data suggest, when compared to that of Crouch et al. (1961) and Piomelli and Brooke (1961), that a spectrum of the degree of graft rejection exists for this species and that hemolysis of host erythrocytes occurs in HBM hosts exhibiting donor type erythrocytes. (auth)

7920 BONE MARROW TRANSPLANTATION IN IRRADIATED MONKEYS. F. E. Newsome, A. H. Tuttle, C. H. Jackson, and R. R. Overman (Univ. of Tennessee, Memphis). p.73-85 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Results are reviewed from a study of the response of irradiated rhesus (Macaca mulatta) and cynomolgus (Macaca irus) monkeys to homologous and heterologous bone marrow transplantations. Data are presented on a group of homologous transplants in rhesus monkeys in which the bone marrow was injected either 30 or 48 hrs after sublethal x irradiation, two heterologous transplants between rhesus and cynomolgus monkeys after exposure to 700 r, and a group of homologous transplants in cynomolgus monkeys after various lethal doses of x irradiation. The function of the donor marrow with respect to erythrogenesis was followed by paper electrophoretic analysis of the recipient's hemoglobin. The data indicate that the transplanted marrow functioned temporarily in some of the animals. (C.H.)

7921 SOME ASPECTS OF PROTECTION OF RHESUS MONKEYS AGAINST LETHAL IRRADIATION WITH AUTOLOGOUS CELLS. R. Schofield, E. Paterson, and M. V. Haigh (Christie Hospital and Holt Radium Inst., Manchester, Eng.). p.87-100 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Monkeys exposed to doses of 800 to 850 rads x radiation were given injections of their own bone marrow removed within 12 hr before irradiation. Some of the animals received a routine course of antibiotics while others were treated in response to symptoms. Of the 19 monkeys irradiated, 6 survived beyond 30 days and 5 apparently recovered. The remainder died 7 to 23 days after irradiation. A bacteremia was detected in all animals that died within 30 days after irradiation. All of the survivors were given antibiotics routinely. The length of survival could not be equated in any way with the number of bone marrow cells administered. (C.H.)

7922 PATHOLOGY OF SECONDARY DISEASE IN PRIMATES. M. J. de Vries (Radiobiological Inst., TNO,

Rijswijk (Z. H.), Netherlands). p.101-36 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

The most important lesions found in primate chimeras resulting from the grafting of homologous bone marrow in irradiated monkeys and man are briefly reviewed, and reaction mechanisms involved in their induction are discussed. Dermatosis and other signs of degenerative changes in epithelium were observed in all cases. Severe intestinal changes were also present in almost all cases. The extent of these lesions was out of proportion to the radiation dose. These observations led to the provisional conclusion that mortality caused by secondary disease in primates is pathogenetically more directly related to graft anti-host activity than in bone marrow treated mice and that lymphoid cells are of prime importance in its production. The function of lymphoid cells and their role in the early death of primate chimeras are discussed. (C.H.)

7923 BONE MARROW TRANSPLANTATION IN THE RHESUS MONKEY. PROGRESS REPORT. L. M. van Putten (Radiobiological Institute TNO, Rijswijk (Z. H.), Netherlands). p.137-51 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Results are reported from studies on the cause of the severity of secondary disease in rhesus monkeys given bone marrow injections after lethal irradiation. Secondary disease was observed in monkeys only when a take of donor cells occurred. It occurred usually very early after bone marrow transplantation and is generally much more severe in primates than in rodents. Efforts to prevent the fatal outcome of secondary disease are described. Best results were obtained when hematopoietic cells from fetal donors were injected. (C.H.)

7924 EVIDENCE RELATING TO THE IMMUNOLOGICAL CAPACITY OF HUMAN FOETAL TISSUES. H. E. M. Kay, J. H. L. Playfair, Margaret R. Wolfendale, and P. K. Hopper (Royal Marsden Hospital, London). p.169-85 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

The development of the lymphoid system and immunity in man are reviewed. Evidence is presented that in man and sheep the lymphoid system develops during intrauterine life but that immunological activity is not usually manifest until later, and when it does occur it is in response to certain prenatal infections. Results are summarized from 4 cases of prenatal fetal liver transplantations in human cases of erythroplastosis fetalis. Factors involved in secondary immune response are discussed. (C.H.)

7925 AN ATTEMPT TO DETERMINE THE AGE AT WHICH "CELLULAR IMMUNOLOGICAL MATURITY" DEVELOPS IN THE FOETAL RHESUS MONKEY. D. R. Bangham, P. Mary Cotes, K. R. Hobbs, and D. E. H. Tee (National Inst. for Medical Research, London). p.187-94 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Adult homologous bone marrow cells were injected in 17 fetal rhesus monkeys of various ages in an attempt to determine the age at which cellular immunological maturity develops. The babies were challenged with an intravenous injection of spleen cells from the respective donor and a skin graft from the donor was applied on the day the spleen cells were given. The initial reaction looked like an accelerated reaction characteristic of an immunized host. It was tentatively concluded that the 9-week fetus was able to reject an immunologically competent graft. This corresponded to the time when lymphocytes were demonstrated in fetal blood. (C.H.)

7926 CORRELATION OF SKELETAL GROWTH AND EPIPHYSEAL OSSIFICATION WITH AGE OF MONKEYS. II. MATURATION EXTENDED THROUGH 75 MONTHS. Donald B. Gisler, Stephen G. Wilson, Jr., and Gerrit L. Hekhuis (School of Aviation Medicine, Brooks AFB, Tex.). p.195-203 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

A method of estimating age in the rhesus monkey is presented. Some thirty-five ossification changes were used as age-estimating criteria. Females generally meet the maturation criteria 3 to 5 months sooner before puberty and 6 to 10 months sooner than males as the age increases. After 75 months all observed centers of ossification appeared complete in the male. (auth)

7927 CARE OF CHIMPANZEES FOR RADIATION STUDIES. A. J. Riopelle and O. J. Daumy (Yerkes Labs. of Primate Biology, Orange Park, Fla.). p.205-30 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

The general characteristics of the chimpanzee (Pan troglodytes) as a laboratory animal are described. Procedures and precautions in its maintenance and handling are discussed. (auth)

7928 PROBLEMS IN THE SANITATION OF MONKEYS FOR WHOLE-BODY IRRADIATION EXPERIMENTS. D. van der Waay and W. M. Th. Zimmerman (Radiobiological Institute TNO, Rijswijk (Z. H.), Netherlands). p.231-43 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Procedures and precautions in the maintenance and handling of rhesus monkeys (Macaca mulatta) are described. Emphasis is placed on procedures for the detection and elimination of pathogens. (C.H.)

7929 TAMARINUS NIGRICOLLIS AS A LABORATORY PRIMATE. N. Gengozian, J. S. Batson, and T. A. Smith (Oak Ridge Inst. of Nuclear Studies, Tenn.). p.245-71 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Results are reported from a tentative evaluation of the primate, Tamarinus nigricollis, as a laboratory research animal. The care, feeding, control of parasites, and routine hematologic examinations of these animals are described. The feasibility of breeding in the laboratory and the occurrence of twinning make this animal a suitable laboratory primate. Preliminary data indicate the animals

are more radiosensitive than other species of primates studied. (C.H.)

7930 A SYSTEMIC DERMATOSIS OF UNCERTAIN ETIOLOGY (X-DISEASE?) IN MONKEYS. M. J. de Vries (Radiobiological Institute TNO, Rijswijk (Z. H.), Netherlands). p.273-82 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Pathological features are described of a systemic dermatosis in monkeys. The main symptom of the disease is a patchy loss of hair of the scalp, trunk, extremities, and tail. The skin itself shows thickening, formation of coarse wrinkles, scaling, and an unusual prominence of the hair follicles. Abscesses were observed at the base of the tail. Blepharitis is a common symptom, and the eyelids are red and edematous, with white dots sometimes seen on the margin of the lids. Anemia was found in many of the animals affected. Autopsy findings included lesions of the skin, stomach, intestinal tract, liver, pancreas, and gall bladder. The etiology of the disease is not clear. The pathological findings resemble those resulting from chronic exposure to a poison with anti-vitamin-A properties. Since a group of chlorinated naphtalenes will produce these symptoms, and these compounds are added to commercial machine oil, an effort was made to find a source of contact with lubricating oils. (C.H.)

7931 AUTOLOGOUS AND ISOLOGOUS BONE MARROW THERAPY IN MAN. N. B. Kurnick (Univ. of California, Los Angeles and Veterans Administration Hospital, Long Beach, Calif.). p.289-307 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

The validity of bone marrow implantation in man and the indications for such implantation are discussed. Experience with autologous and isologous bone marrow infusion in man are reviewed. It is concluded that storage of autologous bone marrow and subsequent reinfusion permits the extension of radiotherapy with increased chance of cure, particularly in testicular tumors and lymphomata. (C.H.)

7932 HUMAN APPLICATION OF BONE MARROW GRAFTING. J. G. Humble (Westminster Hospital, Eng.). p.309-19 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Results are reviewed from applications of bone marrow infusions in the treatment of hematological depression following radiotherapy in humans. Ten cases of widely disseminated malignancy were treated with radiation followed by autologous bone marrow therapy. Results indicate that stored autologous bone marrow cells are active in repopulating the marrow after considerable radiation damage. Results are also reported on 5 cases of leukemia given homologous bone marrow after whole-body radiation treatment. (C.H.)

7933 INFUSION OF HOMOLOGOUS AND AUTOLOGOUS BONE MARROW IN THE TREATMENT OF A VARIETY OF MALIGNANT CONDITIONS. Joseph M. Hill and Ellen Loeb (J. K. and Susie L. Wadley Research Inst. and Blood Bank, Dallas). p.321-38 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

An attempt of homologous bone marrow transplant following total-body radiation in six patients with acute leukemia is presented. The results were disappointing but it was felt that further exploration of this method of treatment may be worthwhile. A total of 38 autologous bone marrow replants were performed with satisfactory response in 21. There is still the question as to whether this is a replant or recovery. Regardless of this, autologous bone marrow preservation has given us more confidence in using more massive chemotherapy in malignant disease and leukemia. A method of determining viability through the stathmokinetic index was evaluated. (auth)

7934 BONE MARROW TRANSPLANTATION AND CHEMICAL PROTECTION AGAINST ALKYLATING AGENTS IN THE THERAPY OF NEOPLASTIC DISEASES. Julian L. Ambrus, Clara M. Ambrus, Leon Stutzman, and Nathan Back (Roswell Park Memorial Inst., Buffalo and Univ. of Buffalo). p.339-54 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Bone marrow transplantation and aminoethylisothiuronium (AET) protected mice and monkeys against lethal doses of nitrogen mustard. Autologous bone marrow transplantation allowed administration of high doses of a new chemotherapeutic agent, AB 103. Take of autologous bone marrow can be determined by determining leukocytosis induced by Pyrexal, a bacterial lipopolysaccharide. (auth)

7935 PRACTICAL APPROACHES TO CHEMICAL RADIATION PROTECTION IN PRIMATES. J. R. Newsome, B. G. Crouch, F. E. Newsome, and R. R. Overman (Univ. of Tennessee, Memphis). p.375-92 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Results are reported from an investigation of chemical agents to afford protection against both lethal and sublethal acute whole-body x irradiation in mammals. Preliminary studies of potentially radioprotective compounds were carried out in dogs. Later studies were carried out in the rhesus monkey (Macaca mulatta). The most promising compounds found were aminoethylisothiuronium (AET), a sulfhydryl compound, and para-aminopropiophenone (PAPP), a hypoxic methemoglobin-producing agent. Both compounds were studied intensively both alone and in combination with regard to toxicity, pharmacology, and radioprotective properties. The effect of method of administration on response was also studied. Data are summarized. (C.H.)

7936 CHEMICAL PROTECTION IN IRRADIATED MONKEYS. George S. Melville, Jr., G. W. Harrison, Jr., A. A. McDowell, and Thomas P. Leffingwell (U. S. Air Force, Austin, Tex; Univ. of Texas, Austin; and School of Aerospace Medicine, Brooks AFB, Tex.). p.393-429 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

The protective effects of various chemical compounds

against radiation injuries were investigated in monkeys, (Macaca mulatta). Drugs of similar mechanisms, drugs of different mechanisms, drugs by different routes of administration, drugs and various types of postirradiation supportive treatment were combined. AET-cysteine is a drug system which can be used either intravenously or orally and permits up to 40% reductions in the more toxic material. This basic drug can be used with either a sedative or a vasoconstrictor to achieve protection at lower drug doses or higher radiation doses. The classical depressions of the peripheral blood cell counts and of the cellularity of the bone marrow are not prevented. However, clinical condition is usually improved and survival time is extended even when 30-day mortality statistics are not improved. In effect, the total damage to these primates from these particular radiation doses has been reduced and the normal repair processes are then capable of sustaining life in a majority of the animals. Two new problem areas have been suggested: the problem of both protecting against and treating the subacute radiation death and the problem of protecting lymphoid tissue and function. (auth)

7937 CHEMICAL PROTECTION OF RHESUS MONKEYS AGAINST LETHAL DOSES OF X-RADIATION. J. L. Van Lancker, R. C. Wolf, and J. B. Mowbray (Univ. of Wisconsin, Madison). p.431-49 of "Proceedings of the International Symposium on Bone Marrow Therapy and Chemical Protection in Irradiated Primates." Rijswijk (Z. H.), Netherlands, Radiobiological Institute of the Organization for Health Research TNO, 1962.

Results are reported from a study of the hematological, pathological, and biochemical changes that occur in rhesus monkeys exposed to a single whole-body dose of 800 r x radiation. The protective effects of either aminoethylisothiuronium (AET) and cysteine or β-mercaptoethylamine (MEA) and cysteine were measured. The data show that AET and cysteine are effective in protecting rhesus monkeys against lethal effects of a single 800 r exposure to x radiation. A marked cellular regeneration of spleen and bone marrow is evident in protected monkeys within 30 days following irradiation. Results obtained in rodents, although of great importance in screening radio-protective agents, cannot a priori be extrapolated to primates. (C.H.)

CHEMISTRY

General and Miscellaneous

7938 (AERE-I/M-15) THE QUANTITATIVE CONVERSION OF IRON TO THE CHEMICAL FORM OF POTASSIUM FERROCYANIDE ON THE SCALE OF ABOUT 50 MILLIGRAMS OF IRON. W. J. Arrol, J. Chadwick, and J. Eakins (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Nov. 13, 1951. 2p.

The Szilard-Chalmers process can be used for the preparation of high-specific-activity Fe^{59} free from Fe^{55} if the potassium ferrocyanide used as target material is synthesized from Fe^{58}. A method of quantitatively converting batches of about 50 mg of Fe^{58} to potassium ferrocyanide is described. (J.R.D.)

7939 (AERE-R-4187) CONSIDERATIONS OF SOME METHODS FOR THE DETERMINATION OF THE COMPOSITION OF A COMPLEX IN A TWO PHASE SYSTEM. T. B. Pierce and P. F. Peck (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Nov. 1962. 10p.

Many two-phase extraction procedures, in which a complex is formed by reaction between an n-valent metal, and a ligand derived from a weak acid, were explained by assuming that combination of metal and ligand occurs in an aqueous phase, but that uncharged species are free to partition into an organic phase. Using this model, equations were derived for a simple general case, which indicates that when there is little dissociation of the complex, three methods widely used for the determination of metal-ligand ratios in a monophase, the Harvey-Manning slope ratio method, the molar ratio method of Yoe and Jones, and Job's method of continuous variations, may be equally well applied to a two-phase system. Again for a strong complex it is shown that it is possible to find the position of the Job extremum and calculate the Harvey-Manning slope ratio from one series of continuous variation measurements, rather than carrying out Job and Harvey-Manning determinations separately. (auth)

7940 (HW-73747(Rev.)) ALUM PRODUCTION STUDIES. G. Jansen, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 19, 1962. Contract AT(45-1)-1350. 31p.

Information is presented concerning the thermodynamics, kinetics, and effects of various chemical concentrations on the reaction of bauxite with water and H_2SO_4 in the production of alum. It was found that two reaction vessels in series performed better than a single stirred vessel. No suitable ductile construction materials for the process were found. Fluorocarbon liners are considered a possibility subject to temperature limitations. (J.R.D.)

7941 (ORNL-3373) THERMAL ANALYSIS AND GRADIENT QUENCHING APPARATUS AND TECHNIQUES FOR THE INVESTIGATION OF FUSED SALT PHASE EQUILIBRIA. H. A. Friedman, G. M. Hebert, and R. E. Thoma (Oak Ridge National Lab., Tenn.). Jan. 4, 1963. Contract W-7405-eng-26. 34p.

A detailed description is presented of apparatus and methods used at ORNL for determination of high-temperature equilibrium phase relations in condensed systems of molten salts. Principal emphasis is given to experimental techniques required for investigation of non-volatile hygroscopic fluorides. Equilibrium phase behavior is elucidated by the combined results of experiments in which measurements are made of the thermal effects occurring on melting and freezing polycomponent mixtures, and others in which unequivocal identification of solid phases formed during crystallization is obtained. Apparatus devised at ORNL for use in preparation, purification, equilibration, and handling of materials for application in fluoride phase studies is described in detail. The methods and techniques described are unique in providing such large quantities of phase data that phase diagrams of complex systems may be constructed in a relatively short time. (auth)

7942 A RADIOMETRIC STUDY OF THE FORMATION OF A CALCIUM FILM AT A SOLUTION-AIR INTERFACE, AND THE EFFECT OF THE FILM ON THE FLOTATION ADHERENCE. M. A. Eigeles, M. L. Volova, V. S. Volvenkova, and E. G. Umnova (Central Research Inst. of Ores and Minerals, USSR). Dokl. Akad. Nauk SSSR, 147: 166-9 (Nov. 1, 1962). (In Russian)

The amount of material in a surface layer of solution was determined by beta scintillation counting and by comparing the activity of the surface layer of solution with a dry standard. A monolayer of the surface-active agent, sodium tridecyl tagged with C^{14}, could readily be detected by this method. Calcium chloride tagged with Ca^{45}, sodium oxalate tagged with C^{14}, and sodium hydroxide were used to study the interfacial surface and induction time for the adherence of a mineral particle to an air bubble. The activities of tagged $CaCl_2$ and $Na_2C_2O_4$ solutions were found to be directly proportional to the concentration. Solutions of $CaCl_2$ and $Na_2C_2O_4$ show no surface activity and can be used as standards characterizing the activity of a volume of solution. The addition of a second electrolyte to the $CaCl_2$ solution ($CaCl_2$ + NaOH, or $CaCl_2$ + $Na_2C_2O_4$) leads to an increase in the surface radioactivity of the solution. The higher the concentration of NaOH and $CaCl_2$, the higher is the surface radioactivity of the solution. Even though the concentration of Ca^{2+} and OH^- is less than the solubility product of $Ca(OH)_2$ in all cases, calculations show that the amount of calcium in the surface layer rises from 3×10^{-10} to 600×10^{-10} gram-moles/cm^2 in a period of 10 minutes (from a fraction of a monolayer to 15 monolayer per calcium ion). Tracer studies show that oxalate ion as well as calcium ion is assimilated by the surface layer. It is assumed that colloid formation takes place. The formation of a film of insoluble reaction products in the surface layer first improves the flotation properties of a solution, but when the film becomes thick enough and stable, the adherence of mineral particles decreases. (TTT)

7943 A STUDY OF PROTACTINIUM COMPLEXING BY A NUMBER OF ORGANIC ACIDS. (BY THE METHOD OF ION EXCHANGE). I. Geletseany and A. V. Palitskii (Moscow State Univ.). Doklady Akad. Nauk SSSR, 147: 372-5(Nov. 11, 1962). (In Russian)

Tracer Pa^{233}, isolated from irradiated thorium nitrate by ion exchange, was used to follow complexing of protactinium by lactic acid, α-hydroxy-isobutyric acid, mandelic acid, malic acid, tartaric acid, trihydroxy glutaric acid, oxalic acid, citric acid, aconitic acid, and ethylenediaminetetraacetic acid. The distribution coefficients were determined for the cation exchanger Dowex 50 and the anion exchanger Dowex 1 at a constant ionic strength of $\mu = 0.25$. The pH

was held constant at ~1.0, and the concentration of complexing agent was varied. Instability constants were calculated by the methods of Paramonova and of Froneus. On increasing the concentration of the complexing agent or the pH of the medium, the distribution coefficient dropped off due to the formation of large polynuclear complexes, and to an increase in hydrolysis. In strong acid solutions, polymerization of Pa takes place by the formation of Pa-O-Pa oxygen bridges. In weakly acid solutions, polymerization of Pa takes place by intramolecular hydrogen bonding between hydroxy groups. Mandelic acid did not form polymers with Pa. The stability of the protactinium complexes with the various complexing agents decreases in the following order: EDTA > citric > oxalic > trihydroxyglutaric > α-hydroxyisobutyric > tartaric > malic > mandelic > lactic > aconitic. (TTT)

7944 THE INTERACTION OF TRI-N-BUTYL PHOSPHATE (TBP) WITH NITRIC ACID AND WITH WATER. A. V. Nikolaev, K. E. Mironov, and E. V. Karaseva (Inst. of Inorganic Chemistry, Siberian Academy of Sciences, USSR). Doklady Akad. Nauk SSSR, 147: 380-3(Nov. 11, 1962). (In Russian)

The specific gravity and viscosity of solutions were measured at 25°C for the liquid phases in the systems of TBP–HNO, TBP–H_2O, and TBP–HNO_3–H_2O, in order to detect any interaction of TBP with HNO_3 or with H_2O. Measurements of density and viscosity were also carried out at 0°C for the TBP–HNO_3 system. The viscosity curve for the TBP–HNO_3 system shows a maximum at 0°C, which disappears at 25°C. In the TBP–H_2O system, 50.8 mole % water dissolves in the TBP, and 2.7×10^{-3} mole % TBP dissolves in the water. However, the specific gravity and viscosity data cannot prove the existence of a TBP–H_2O complex, but do show that interaction takes place. In the ternary system TBP–HNO_3–H_2O, the amount of TBP in the aqueous phase increases with >20 mole % HNO_3 in the aqueous. No third phase formation was observed. The composition of the critical solubility point was found to be 3.8% TBP, 65.7% HNO_3, and 30.5% H_2O. The maximum viscosity was observed at 23% HNO_3 and 3.5% H_2O. A plot of the solubility of various components and of the viscosity is given in triangular coordinates. (TTT)

7945 THE THERMAL DEHYDRATION OF SILICA XEROGEL PROMOTED BY ALKALINE-EARTH CHLORIDES. N. Henry and R. A. Ross (Royal Coll. of Science and Tech., Glasgow). J. Chem. Soc.: 4265-8(Nov. 1962).

The rate of dehydration of silica xerogel was studied at a series of fixed temperatures from 300 to 970° in air. In addition, the effect on the dehydration rate of adding calcium, barium, and strontium chloride in concentrations up to 6.6 moles % was examined. X-ray and chemical analysis were used to determine the extent of halide-gel interactions in the solid phase. Dehydration of silica gel surfaces was accelerated by the additives, probably by a catalytic effect below 800°, but above 800° formation of metal silicate occurred along with evolution of hydrogen chloride. (auth)

7946 THE REMOVAL OF LOW CONCENTRATIONS OF IODINE FROM AIR ON A PLANT SCALE. J. B. Morris, H. R. Diffey, B. Nicholls, and C. H. Rumary (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Energy, Pts. A and B, 16: 437-45(Sept. 1962).

Experiments are described in which the performance of three types of absorber for removal of iodine was assessed. The absorbers, which were each preceded by an "absolute" filter, were respectively a sodium carbonate liquid scrubber, a bed of knitted copper mesh, and a bed of granulated activated charcoal. The flow through each system was in the range 2000 to 3000 cfm. The iodine was released as elemental iodine vapor in a reactor shell of volume 7000 m^3 to give an initial concentration of about 1 μg I^{127} and 7 μc I^{132} per cubic meter of air. The results showed that the efficiency of each system decreased with time after the iodine was released and it is concluded that this was due to the partial change of the elemental iodine vapor into a form which was not so easily adsorbed. At all stages of the tests the decontamination factor of the charcoal bed was superior to that of the other two systems. (auth)

7947 STORAGE OF STANDARDIZED RADIOACTIVE SOLUTIONS. R. L. G. Keith (Atomic Weapons Research Establishment, Aldermaston, Eng.). Nature, 196: 500 (Nov. 3, 1962).

Results of a series of international intercomparisons of radioactive counting techniques indicated that specific activity of stored radioactive standardized solutions was increasing with time. This increase was attributed to transpiration from the polythene containers in which the solutions were transported. Tests showed rates of change of up to 8%/annum. Transpiration was reduced to acceptable levels by storing the polythene containers in an enclosed space over water. (C.H.)

7948 A TRITIUM ISOTOPE EFFECT ON ION EXCHANGE CHROMATOGRAPHY. Hubert Gottschling and Ernst Freese (Univ. of Wisconsin, Madison). Nature, 196: 829-31(Dec. 1, 1962).

When tritiated 2-aminopurine was eluted from an anion exchange column the tritiated molecules moved slightly faster than the non-tritiated ones. This effect is apparently caused by a charge difference between the molecular species since their steric difference is extremely small and since the column used mainly distinguishes molecules of different average charge. Results are reported from a detailed examination of the isotope effect with purified aminopurine. (C.H.)

7949 PREPARATION OF CARRIER-FREE Pr^{143} BY ION EXCHANGE. Haruo Natsume (Japan Atomic Energy Research Inst., Tokyo). Nippon Genshiryoku Gakkaishi, 4: 758-65(Nov. 1962). (In French)

The 10 mc order Pr^{143} was purified by the ion exchange following by the elimination of the most part of cerium as ceric phosphate precipitate. The purity of this source was examined and the yields of radioactive praseodymium were measured during the first precipitation, the reprecipitations and the ion exchange purification. Several remarks on the preparation of an extremely pure source was mentioned. (auth)

7950 INFRARED SPECTRA OF CHLOROPHYLL AND ITS ANALOGUES. II. ISOTOPIC EXCHANGE BETWEEN CHLOROPHYLL AND PHEOPHYTIN MOLECULES AND HEAVY WATER MOLECULES. A. N. Sidorov. Opt. Spectr. (USSR) (English Transl.), 13: 206-8(Sept. 1962).

It is found, using the methods of isotopic exchange and infrared spectroscopy, that molecules of chlorophyll and molecules of water can, in vitro, exchange their hydrogen atoms in solution as well as in the system solid chlorophyll-water vapor. Isotopic exchange is also found to occur between molecules of pheophytin and heavy water. The hydrogen atoms of the imine NH groups of pheophytin participate directly in the exchange. Isotopic exchange in chlorophyll as well as in pheophytin is accelerated by the presence of the organic base pyridine, whose role consists, apparently, in the activation of water molecules. An interpretation of the absorption bands of the pigments is given, and an hypothesis proposed concerning the location in these mole-

cules of hydrogen atoms capable of exchanging with D in the presence of heavy water. (auth)

7951 FLAME FUSION GROWTH OF C-TYPE RARE-EARTH OXIDES. R. A. Lefever (General Telephone and Electronics Labs., Inc., Palo Alto, Calif.). Rev. Sci. Instr., 33: 1470-1(Dec. 1962).

A procedure for growing rare-earth oxide crystals with a flame fusion burner is given which gives crack-free crystals after cooling. In the procedure, growth conditions are used which result in the continual formation of a thick layer of sintered powder around the boules during growth. The layer probably reduces thermal radiation and hence the stress during cooling. (D.L.C.)

7952 NEW REDOX SYSTEMS. V. OXIDATION OF URANIUM^{IV} WITH IRON^{III} IN 1,10-PHENANTHROLINE SOLUTIONS INDIRECT COLORIMETRIC DETERMINATION OF URANIUM. František Vydra and Rudolf Přibil (Polarographic Inst., Czechoslovak Academy of Sciences, Prague). Talanta, 9: 1009-14(Dec. 1962). (In English)

The oxidation of uranium(IV) with iron(III) in the presence of 1,10-phenanthroline was studied both potentiometrically and colorimetrically. Suitable conditions for the indirect colorimetric determination of uranium via ferroïn were found. (auth)

Analytical Procedures

7953 (CUA-NE-24) AMERICIUM–BERYLLIUM AND PLUTONIUM–BERYLLIUM NEUTRON SOURCE RELATIVE EFFECTIVENESS IN PROMPT-GAMMA ACTIVATION ANALYSIS. E. D. Jordan and H. E. Schierling (Catholic Univ. of America, Washington, D. C.). Nov. 1962. Contract AT(30-1)-2586. 46p. (NYO-9918)

The relative effectiveness in prompt-gamma neutron activation analysis of two Pu–Be isotopic neutron sources and an Am–Be neutron source is compared. Thermal neutron levels and the associated gamma radiation produced by these sources in a standard moderating system are normalized to the nominal neutron emission rate. The methods of measurement include a BF_3 neutron detector, a Geiger-Mueller gamma detection tube, and an NaI scintillation crystal. The normalized thermal neutron level for both sources is the same. The Am source has a higher gamma radiation level than the Pu source of the same neutron emission rate. The higher gamma radiation level is primarily the result of the higher energy gamma ray emitted in the decay of Am^{241}. (auth)

7954 (HW-75384) A COINCIDENCE COUNT ALPHA PARTICULATE AIR MONITOR. D. P. Brown, M. O. Rankin, C. D. Boyne, and W. G. Spear (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 3, 1963. Contract AT(45-1)-1350. 23p.

An alpha monitor for the detection of airborne plutonium was developed and tested satisfactorily. The measured plutonium alpha detection sensitivity is 15 MPC-HOURS; that is, a continuous alpha air concentration of 2×10^{-12} μc/cc (one MPC for a 40 hour week) can be detected with consequent alarm energizing after a 15 hour collection period. This sensitivity can be attained even under extreme natural alpha emitter (radon-thoron) concentration conditions of 2×10^{-10} μc/cc. The time-to-alarm or inherent sensitivity is linearly related to the continuous plutonium air concentrations in that 2×10^{-11} μc/cc causes alarm in 1.5 hours and 2×10^{-10} μc/cc (100 MPC) causes alarm in 9 minutes. (auth)

7955 (IA-770) ELIMINATION OF PHOSPHATE INTERFERENCE IN FLAME PHOTOMETRIC DETERMINATION OF STRONTIUM AND BARIUM. J. Yofé, R. Avni, and M. Stiller (Israel. Atomic Energy Commission, Rehovoth). Sept. 1962. 15p.

Studies on the interference of phosphate in the flame emission of calcium, strontium, and barium showed that there was a fall of intensity proportional to the quantity of the interfering anion up to a maximum depression for equimolar ratios of PO_4^{-3} to Ca, Sr, or Ba. A thermostable phosphate was formed prior to the entrance of the cation into the flame. Addition of appropriate quantities of lanthanum restored the intensity of the three alkaline earth lines to their values in absence of phosphate. Lanthanum was found to displace calcium, strontium, or barium from their phosphates prior to their entrance in the hot region of the flame. (auth)

7956 (NP-12437) SENSITIVITIES FOR ACTIVATION ANALYSIS WITH THERMAL OR FAST NEUTRONS. Hugh P. Dibbs (Canada. Dept. of Mines and Technical Surveys. Mines Branch). Nov. 20, 1962. 8p.

Available as Can. Dept. Mines and Tech. Surveys, Mines Branch Technical Bulletin TB-40, $0.50.

A table of relevant data is presented for activation analysis by means of slow (thermal) or fast (14 Mev) neutrons. Only the most sensitive reaction was selected for each element, and sensitivities are listed for fast neutron fluxes of 10^9 n/cm^2/sec or thermal neutron fluxes of 10^7 n/cm^2/sec. This information is of value in assessing the possible usefulness of neutron activation for analysis of materials of industrial interest. (auth)

7957 (PAN-330/XIII) CARBON-14 AND TRITIUM MEASUREMENTS USING LIQUID SCINTILLATION COUNTER. Tomasz Radoszewski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). May 1962. 17p.

Application of the liquid scintillation method for C^{14} and tritium measurements is shown. Usefulness of several scintillators is compared and the main advantages and disadvantages of liquid scintillation techniques are discussed. The comparison between single-channel and double-channel system in liquid scintillation technique was also done. The efficiencies of scintillation counters were calculated after measuring C^{14} and tritium standards. (auth)

7958 (PG-Report-348) ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF ALUMINIUM IN MAGNESIUM METAL. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 5p.

The magnesium metal is dissolved in hydrochloric acid. Iron is complexed with O-phenanthroline and the aluminum extracted into chloroform as the 8-hydroxy-quinoline complex at a controlled pH. The optical absorbancy of the chloroform extract is measured using a "Spekker" absorptiometer. The method as written is suitable for the determination of aluminum within the concentration range 10 to 200 ppm. Nickel and cobalt at the 100 ppm level produce an absorbancy equivalent to about one-third this amount of aluminum. They are not normally found in magnesium or are less than 5 ppm. At the 75 ppm level the standard deviation is ±3.9 ppm. The method is considered to be free from bias. (auth)

7959 (RT/CHI(62)13) ANALISI SPETTROGRAFICA DI IMPUREZZE METALLICHE NEL SANTOWAX. (Spectrographic Analysis of Metallic Impurities in Santowax). L. Lorenzini and G. Bracciocurti (Italy. Comitato Nazionale per l'Energia Nucleare. Divisione Materiali, Rome). Oct. 1962. 21p.

A spectrographic procedure for the determination of B, Cd, Fe, Ni, Cr, Mn, and Mo in Santowax OMP is described. The detection sensitivity is 0.05 ppm; the quantitative determination can be carried out to concentrations of 0.25 ppm with a mean standard deviation between 1.7 and 4%. (auth)

7960 (SCTM-14-62(14)) MASS SPECTROGRAPHIC ANALYSIS FOR HELIUM 4 IN A COMPLEX GAS MIXTURE. J. W. Guthrie (Sandia Corp., Albuquerque, N. Mex.). Apr. 1962. Contract [AT(29-1)-789]. 27p.

A mass spectrographic method developed for determining the partial pressures of He^4 in gas mixtures containing hydrogen isotopes, helium isotopes, methane, and species resulting from exchange reactions between components is described. Spectrum lines from singly and doubly charged He^4 ions were used for calibrations and sample analyses. Results obtained from two typical samples are presented. (auth)

7961 (TID-17520) SOLID SAMPLE PREPARATION FOR THE INFRARED SPECTROPHOTOMETER BY FREEZE DRYING. Technical Report No. IV. G. C. Anderson and F. A. Olson (Utah. Univ., Salt Lake City. Inst. of Metals and Explosives Research). Nov. 20, 1962. For Oak Ridge National Lab., Tenn. Contract W-7405-eng-26; Subcontract 3003. 13p.

A technique of preparing solid samples for the infrared spectrophotometer is described. It consists of freeze-drying a solution suspended on a metal screen or grid. The method is compared to other methods currently used and some representative spectra are shown. (auth)

7962 (WAPD-T-1543) RADIOACTIVATION ANALYSIS IN REACTOR TECHNOLOGY. J. E. Hudgens (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 15, 1962. Contract AT(11-1)-Gen-14. 12p.

The radioactivation problems important in reactor technology are outlined. Analysis by radioactivation and analysis of radioactivation are discussed. (M.C.G.)

7963 (CEA-tr-A-1179) UNE MICRO-METHODE POUR LE DOSAGE RAPIDE DE L'IODE DANS LES SOLS. (A Micro Method for the Rapid Determination of Iodine in Soils). D. Ceausescu. Translated into French from Acta Chim. Acad. Sci. Hung., 28: 165-70(1961). 12p.

A method, which is a modification of the official method of the Association of Agricultural Chemists, is described for the rapid determination of iodine in soil. The modification consists of the execution of the analysis with 0.1 g of soil in place of 5 g. The insoluble residue is separated by centrifugation instead of filtration. The alcoholic extract is alkalinized before calcination in order to avoid a loss of volatilized iodine. Instead of colorimetric determination of the iodine, this determination is made by the cerium arsenite method. (J.S.R.)

7964 (CEA-tr-R-1620) COMPARAISONS DES RÉACTIFS UTILISÉS POUR LE DOSAGE COLORIMÉTRIQUE DU ZIRCONIUM. II. pH OPTIMUM ET SPÉCIFICITÉ DE REACTIFS. (Comparisons of Reagents Utilized in Colorimetric Determination. II. Optimum pH and Specificity of Reagents). A. K. Babko and V. T. Vasilenko. Translated into French from Ukr. Khim. Zh., 27: 396-402 (1961). 14p.

The value of the optimum pH and of the specificity of the reaction as well as criteria for the comparison of zirconium reagents was examined. The variation of the coloration of 16 reagents and of the complexes which they form with Zr, Ti, and Al were examined as a function of the pH of the solution. The variation of the optical density when the acidity varies in the limits $pH_{opt} \pm 0.5$ and the quantity of neighboring elements which can be added to 1μg of Zr were taken as the comparison criteria for the Zr reagents. The effect of some masking substances on the colored compounds which Zr, Ti, and Al form with the reagents considered is studied. It was shown that of the reagents studied xylene orange and methylthymol blue were the best for the determination of zirconium. (tr-auth)

7965 (CEA-tr-R-1638) DOSAGE PHOTOMÉTRIQUE DU MOLYBDÈNE À L'AIDE DE STILBAZO. (Photometric Determination of Molybdenum with the Aid of "Stilbazo"). A. I. Busev and Fang Ch'an (Chz/Han Fan'). Translated into French from Vestn. Mosk. Univ., 16: Ser. II: Khim., No. 4, 55-8(1961). 9p.

A spectrophotometric method for the determination of low quantities of hexavalent molybdenum using stilbazo was perfected. Ba, Ca, Mg, Cd, Ni, Zn, Be, Fe^{2+}, and low concentrations of Mn^{2+}, UO_2^{2+}, Cu^{2+}, Al^{3+}, and $Cr_2O_7^{2-}$ do not obstruct the determination. During the determination of Mo in the presence of trivalent Fe, the Fe^{3+} is reduced to the bivalent state by ascorbic acid. (tr-auth)

7966 (UCRL-Trans-893(L)) NEPHELOMETRIC DETERMINATION OF SMALL AMOUNTS OF CESIUM AS CESIUM CADMIUM CYANIDE. A. S. Kozlov. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore) from Redkie Shchelochnye Elementy, Akad. Nauk SSSR, Sibirsk. Otd., Sb. Dokl. Soveshch., 79-85(Nov. 1, 1958). 12p.

The system $CdSO_4 - Cs_4[Fe(CN)_6] - H_2O$ was studied by the method of physical chemical analysis, and it was shown that there is formed in the system a slightly soluble double salt of the compound $Cs_2Cd[Fe(CN)_6]$. A double ferrocyanide of cesium and cadmium was synthesized by way of interaction of Cs_2SO_4 with a solution of $Cd_2[Fe(CN)_6]$ in NaI, and it was established by analysis that the composition of the precipitate corresponds to the formula $Cs_2Cd[Fe(CN)_6]$. A new (nephelometric) method was worked out for determining small amounts of cesium, based on the formation of $Cs_2Cd[Fe(CN)_6]$ in the presence of sodium iodide. (auth)

7967 DETERMINATION OF TRACES OF OXYGEN IN METALLIC SODIUM. J. Minczewski, D. Dancewicz, and S. Wąsowicz (Inst. of Nuclear Research, Polish Academy of Science, Warsaw). Acta Chim. Acad. Sci. Hung., 33: 51-7 (1962). (In Russian)

The method is based on the formation of sodium amalgam with mercury. Sodium monoxide is insoluble in the resulting amalgam and floats on the surface. The amalgam is then completely removed by extraction with mercury. Amalgamation is performed in a special extractor in argon atmosphere which is previously purified by passing it through a sodium–potassium alloy. Samples of sodium are stored in glass capsules. Following the extraction, sodium monoxide is dissolved in water, and oxygen is determined indirectly by flame photometry. Sodium is determined either by hydrolyzing the amalgamate followed by titration of excess acid and sodium hydroxide to a phenolphthalein end point or by flame photometry. The size of the sample amounted to 1 g sodium. This method was used to determine oxygen in amounts above 50 ppm. The standard deviation of several series of analysis did not exceed 13 ppm. (auth)

7968 DETERMINATION OF SILICON IN URANIUM. C. Boirie and R. Platzer (Centre d'Études Nucléaires, Saclay, France). Acta Chim. Acad. Sci. Hung., 33: 267-74(1962). (In French)

A colorimetric method was evolved for the determination of the silicon content in uranium without the previous sepa-

ration of uranium. The method is based on the formation of silicomolybdate at a pH value of 1.6. This is followed by reduction of the product in a medium of 2 N sulfuric acid, using a solution of iron(II) sulfate in oxalic acid as reducing agent. Mainly the conditions of dissolving the sample without any silicon loss are discussed. On the basis of the experimental results, a procedure was evolved for processing samples by nitrofluorohydric acid where the uranium sample can be dissolved without any loss of silicon. (auth)

7969 DETERMINATION OF URANIUM IN MINERALS. C. Boirie and R. Platzer (Centre d'Études Nucléaires, Saclay, France). Acta Chim. Acad. Sci. Hung., 33: 275-80 (1962). (In French)

Uranium is extracted from the sulfuric acid solution of uranium minerals by the benzene solution of a symmetrical tertiary amine (e.g., of tri-n-octylamine) whose dissociation constants were established. In the second step, uranium is extracted from the obtained solution by a 0.5 M aqueous solution of sodium carbonate. On treating the extract with a 3% solution of hydrogen peroxide, the quantity of uranium is determined by colorimetry. (auth)

7970 DETERMINATION OF MINUTE TRACES OF URANIUM IN BIOLOGICAL SUBSTANCES (BLOOD AND ORGANS). C. Boirie, D. Bosc, G. Hugot, and R. Platzer (Centre d'Études Nucléaires, Saclay, France). Acta Chim. Acad. Sci. Hung., 33: 281-6(1962). (In French)

Subsequent to mineralization and dissolution of the samples, uranium is extracted from the solution by a benzene solution of a symmetric tertiary amine. The extraction of iron can be inhibited by a previous treatment with hydroxylamine sulfate in order to reduce iron to its divalent form. In the next step, uranium is extracted by a solution of ammonium carbonate. In an aliquot of the obtained extract, uranium is determined by fluorimetry after fluxing with sodium fluoride. The results obtained by this method proved its suitability for the determination of uranium in blood and various organs (such as lungs, liver, kidneys, etc.). (auth)

7971 DETERMINATION OF THE NITROGEN CONTENT OF THE SURFACE OF ZIRCONIUM AND OF ZINC ALLOYS. A. Simenauer (Centre d'Etudes Nucléaires, Saclay, France). Acta Chim. Acad. Sci. Hung., 33: 295-7 (1962). (In French)

In zirconium and in zinc alloys, the determination of nitrogen traces in the surface layer is of importance because the corrosion of these structural materials applied mainly in nuclear reactors is promoted to a great extent by nitrogen contents exceeding 50 ppm or by superficial nitrogen contaminations occurring during processing of metals. According to the evolved method of determination, the metal sample is treated with a mixture of 6M hydrochloric acid and 1M hydrofluoric acid. The metal is attacked by this mixture very slowly and homogeneously. Thus, on boiling the metal an hour with the acid mixture, only a layer of about 50 μ thickness dissolves. The obtained solution is subjected to alkaline distillation, and then the quantity of ammonia in the distillate is determined by colorimetry based on the Berthelot reaction (color reaction with phenol and hypochlorite in an alkaline medium). According to the presented results of investigation, the contamination of metals with nitrogen is limited to a surface layer of a thickness below 50 μ. (auth)

7972 NEW METHOD OF SEPARATION OF RADIOACTIVE RUBIDIUM AND CESIUM BY CHROMATOGRAPHY. A. K. Lavrukhina, V. Kouřim, and S. S. Rodin. Acta Chim. Acad. Sci. Hung., 33: 309-16(1962). (In Russian)

A selective method of concentration was evolved for the analysis of a mixture of radioactive rubidium and cesium. For this purpose, the coprecipitation phenomena of the alkali metals with free heteropolyacids were utilized. The coprecipitation of Cs^{137} and Rb^{86} with di-, tri-, and tetrapolyacids was studied. It was found that precise and complete separation is possible with the aid of a column filled up with a mixture of asbestos and phosphotungstenic acid. (auth)

7973 ISOLATION AND DETERMINATION OF MINUTE AMOUNTS OF RARE EARTHS METALS IN ROCKS AND MINERALS. N. Jordanov and Ch. Daiev (Univ. of Sofia). Acta Chim. Acad. Sci. Hung., 34: 151-5(1962). (In German)

A method is suggested for the isolation and determination of minute amounts of rare earth metals in rocks and minerals. The sample is processed with acids, then the rare earth metals, together with the accompanying metals, are co-precipitated from the solution by ammonia, and the filtered precipitate is converted into oxides by ignition. The oxides obtained in this way are subjected to chlorination under prescribed conditions, and the rare earth metals are determined in the residue with the aid of "arsenazo" in the presence of sulphosalicylic acid in a hexamethylenetetramine buffer. (auth)

7974 THE USE OF BISMUTH RADIONUCLIDES IN ANALYSIS. PART II. THE DETERMINATION OF RADON IN WATERS. J. R. W. Kerr, D. I. Coomber, and D. T. Lewis (Dept. of Scientific and Industrial Research, London). Analyst, 87: 944-8(Dec. 1962).

A rapid radiochemical method is described for determining radon in water, based on the equilibrium of bismuth-214 with its parent radon. This bismuth isotope is precipitated from solution by n-propyl gallate with inactive bismuth as a carrier. The precipitate of bismuth propyl gallate is collected on a filter, dried, mounted and β-counted on a conventional instrument. The lower limit of sensitivity is about 20 picocuries per liter when a simple Geiger assembly is used. The storage in polythene containers of water samples taken for analysis is not recommended, as this polymeric material can absorb radon gas from aqueous solutions. (auth)

7975 THE BORON-CURCUMIN COMPLEX IN THE DETERMINATION OF TRACE AMOUNTS OF BORON. M. R. Hayes and J. Metcalfe (United Kingdom Atomic Energy Authority, Springfields Works, Lancs, Eng.). Analyst, 87: 956-69(Dec. 1962).

A simple and robust method is described for the formation of the complex of boron with curcumin. The sensitivity of the method is 6.0 to 6.5×10^{-5} μg per sq. cm by Sandell's definition. Formation of the complex is believed to be quantitative under the conditions used, and some evidence is given for a ratio of boron to curcumin of 1 to 3. Methods are outlined for determining boron in some metals, compounds, and organic materials. (auth)

7976 DETERMINATION OF THE FUEL ELEMENT BURNUP BY MEANS OF A MAGNETIC γ-SPECTROMETER. L. V. Groshev and A. M. Demidov. At. Energ. (USSR), 13: 458-66(Nov. 1962). (In Russian)

Methods previously employed for determining the U^{235} burnup of fuel elements required the use of a mass spectroscope with hot fuel, therefore necessitating extended waiting periods. This situation was improved by the use of a nondestructive method based on a magnetic Compton spectrometer which allowed the burnup to be determined by the intensity of the γ lines of the fission products formed in the element. The 2.19-Mev γ line of Nd^{144} was found to be useful for this purpose. The measurements may be undertaken

within a few days after the termination of the exposure, requiring only that more than 0.1 g U^{235} be burned up for improving the statistical accuracy. If the fuel is exposed for periods exceeding the 284-day half life of Nd^{144} the conditions of the burning-up must be also taken into account. The 661-kev γ line of Ba^{137}, the half life of which is 26 years, may be used for the study of fuels exposed for several years. (TTT)

7977 DETERMINATION OF ZIRCONIUM WITH HAFNIUM IN ZIRCON VIA PAPER CHROMATOGRAPHIC SEPARATION. I. I. M. Elbeih and G. G. Garba (Univ. of Cairo). Chemist-Analyst. 52: No. 1, 13-14(Jan. 1963).

The separation of zirconium and its associated hafnium from zircon is described. The zircon ore is opened in a classical manner and other elements are separated from zirconium and hafnium by paper chromatography using the antipyrine-dioxane-nitric acid solvent system in which zirconium and hafnium show no movement. The zirconium and hafnium content of the isolated zones is then determined by an ethylenediaminetetraacetate titration procedure. The mean value of the method is 45.73%. (P.C.H.)

7978 THE ACCURACY OF ESTIMATIONS OF COPPER, ARSENIC, AND ANTIMONY BY MEANS OF THE PHOTOPEAK DECAY CURVE OF THE γ-RAY SPECTRUM. U. Hueber. Isotopen Tech., 2: 335-6(Nov. 1962). (In German)

The determination of Sb, As, and Cu by the photopeak decay curve of the gamma spectra is described. At amounts of 0.2, 0.25, and 0.25 μg for Sb, As, and Cu, respectively, accuracies varied with irradiation time. (M.C.G.)

7979 MEASUREMENT OF THE RADIOACTIVITY OF WATER AT THE CZECHOSLOVAKIAN WATER-WORKS LABORATORIES IN COMPARISON WITH FOREIGN MEASURING TECHNIQUES. J. Pazdernîk. Isotopen Tech., 2: 341-3(Nov. 1962). (In German)

The principles of measuring the radioactivity of water that is used at the Czechoslovakian water-work laboratories are described. They are compared with methods used in other countries. (auth)

7980 SPECTROSCOPIC ANALYSIS OF STABLE ISOTOPES. G. Meier (Institut fur Physikalische Stofftrennung, DAW, Leipzig). Isotopen Tech., 2: 343-6(Nov. 1962). (In German)

The various possibilities of optical isotopic analysis are reviewed. The estimations of relative isotopic abundances performed by emission and absorption spectroscopy are discussed along with optical isotope shifts. (auth)

7981 SPECTROPHOTOMETRIC DETERMINATION OF URANIUM BY GALANGIN. Mohan Katyal and R. P. Singh (Univ. of Delhi). J. Indian Chem. Soc., 39: 585-8(Sept. 1962). (In English)

The use of 3,5,7-trihydroxyflavone (galangin) as an analytical reagent for the estimation of uranium was investigated. The reagent forms a water-soluble orange complex with uranium. One to ten ppm of uranium can be satisfactorily estimated spectrophotometrically at 450mμ, the pH of the solutions being adjusted in the range 4.5 and 8.0. Molar composition of the complex was found to be 1:1. (auth)

7982 SPECTROPHOTOMETRIC DETERMINATION OF THORIUM USING CHRYSIN. Mohan Katyal and R. P. Singh (Univ. of Delhi). Proc. Indian Acad. Sci., Sect. A, 56: 125-9(Sept. 1962). (In English)

Easily prepared chrysin forms a yellow colored complex with thorium. The spectrum of the complex shows absorption at 380 mμ at pH 2.8. Also at pH 2.8, the complex obeys Beer-Lambert's law with a thorium concentration between 2 and 36 ppm; and the complex has 1:1 molar composition. (D.C.W.)

7983 AN INVESTIGATION OF REAGENTS FOR NIOBIUM AND TANTALUM. [PART] I. G. Ackermann and S. Koch (Inst. for Inorganic and Analytical Chemistry, Freiburg i B.). Talanta, 9: 1015-22(Dec. 1962). (In German)

On examination of a wide range of hydroxylic organic compounds, it was found that two hydroxyl groups in the ortho position to each other in an aromatic system act as a functional analytical group for niobium and tantalum. peri-Dihydroxynaphthalene derivatives react similarly. After a systematic examination, tribromopyrogallol is proposed as a new selective and sensitive reagent for niobium. (auth)

7984 EXTRACTION AND DETERMINATION OF IRON AS THE BATHOPHENANTHROLINE COMPLEX IN HIGH-PURITY NIOBIUM, TANTALUM, MOLYBDENUM AND TUNGSTEN METALS. Elsie M. Penner and W. R. Inman (Dept. of Mines and Technical Surveys, Ottawa). Talanta, 9: 1027-36(Dec. 1962). (In English)

A spectrophotometric method for determining iron in the range 0.001 to 0.125% in high-purity niobium, tantalum, molybdenum, and tungsten metals is described. After sample dissolution and reduction of iron to the bivalent state with ascorbic acid and hydroxylamine hydrochloride, the red complex formed between iron(II) and bathophenanthroline (4,7-diphenyl-1,10-phenanthroline) is extracted into n-amyl alcohol and the absorbance of the resulting extract is determined at 536 mμ. Interference from copper is eliminated with thiourea. Cobalt, cadmium, nickel, manganese, and zinc also interfere, but the amounts of each of these impurities present in the four high-purity metals described are so low that their interference effects are negligible in the proposed method. Highly reproducible and precise results can be obtained with careful control of the pH during reduction and extraction. (auth)

7985 THE USE OF AMMONIUM MOLYBDOPHOSPHATE FOR THE DETERMINATION OF FISSION PRODUCTS. PART I. THE DETERMINATION OF Cs-137 IN SOLUTIONS OF IRRADIATED FUEL. G. M. Allison, R. A. Ferguson, and D. McLaughlin (Atomic Energy of Canada Ltd., Chalk River, Ont.). Revised Oct. 1962. 16p. (CRRL-1069; AECL-1448)

Paper from Sixth Conference on Analytical Chemistry in Nuclear Reactor Technology at Gatlinburg, Tennessee, October 9-11, 1962.

The property of ammonium molybdophosphate (AMP) to remove cesium quantitatively from acid solution was used to separate Cs^{137} from solutions of irradiated UO_2 fuel. In this method the acid solution of UO_2 is passed through a layer of pre-formed AMP in a filter tower. Interference from Zr^{95} is eliminated by complexing it with fluoride which prevents its retention by the AMP. Cerium-144 is adsorbed slightly by the AMP but insufficient counts from the 0.697 Mev Pr^{144} γ ray are present to increase the area of the Cs^{137} photopeak by more than 0.3%. Results obtained with the method were compared with those from a standard radiochemical procedure and the agreement was better than ±5%. In all cases counting was done with a 3 × 3 in. NaI(Tl) scintillation crystal and 100-channel pulse-height analyzer. (auth)

7986 EXTENSION OF SENSITIVITY IN ANALYSIS OF IMPURITIES IN SOLIDS BY MASS SPECTROMETRY. C. M. Stevens (Argonne National Lab., Ill.). p.58-68 of

"Symposium on Extension of Sensitivity for Determining Various Constituents in Metals." Special Technical Publication No. 308. Philadelphia, American Society for Testing and Materials, 1961.

A review is presented of the spark analysis and isotopic dilution methods of mass spectrometry. The outstanding improvements since 1951, the limitations of the methods, and the general trends for overcoming these limitations are discussed. Isotopic dilution and high-sensitivity surface ionization analysis constitute the most sensitive method. (D.L.C.)

Inorganic and Physical Chemistry

7987 (AFCRL-62-627) SPONTANEOUS EMISSION OF PHONONS AND SPECTRAL LINE WIDTHS OF SOME RARE EARTH IONS IN CRYSTALS. Technical Note No. 1. S. Yatsiv (Hebrew Univ., Jerusalem). Jan. 1962. Contract AF61(052)-549. 18p. (AD-277006)

A correlation was found between the line widths in the spectra of rare earth ions in crystals and relaxation processes between closely spaced Stark levels. It was inferred from work on relaxation times between magnetic sublevels that the transition probabilities between neighboring Stark levels are often as high as 10 to the 10th power arc sec. The resulting reduction in the lifetime of such levels is sufficient to broaden optical transitions. Upon continuous excitation at low temperatures, a population inversion is maintained in a large number of energy intervals of these ions. (auth)

7988 (ARF-1184-7) MAGNETIC PROPERTIES OF INSULATORS. Quarterly Report No. 7, August 16, 1962 to November 15, 1962. Jordan J. Markham (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Dec. 1, 1962. Contract AT(11-1)-578. 48p.

An optical study was made of the absorption band associated with the F-center in RbCl. The absorption shape of the F-band was independent of temperature. The absorption associated with the F-center seemed to be independent of the method of production. However, the ratio of the maximum absorption of the K-band to the maximum absorption of the F-band depended on the method of coloration. Preliminary calculations were made for the purpose of comparing experimental and theoretical results of the spin-lattice relaxation time in KCl at low temperatures. Data are presented on the shape and recovery of the hole in an EPR (electron paramagnetic resonance) band associated with the F-center in KCl. The width and shape of the hole were not consistent with the simple theory for inhomogeneous broadening. (M.C.G.)

7989 (BNL-6059) THE STANDARD MOLAR FREE ENERGY OF FORMATION OF $MgCl_2$, $CeCl_3$, $ThCl_4$, AND UCl_3 OBTAINED BY SOLID STATE EMF TECHNIQUES. J. J. Egan, W. McCoy, and J. Bracker (Brookhaven National Lab., Upton, N. Y.). [Mar. 29, 1962]. Contract [AT(30-2)-Gen-16]. 19p.

Daniell cells with solid components were used to study the free energy of formation of chlorides. A typical cell may be represented as follows:

$$Ce,CeCl_3(s)|BaCl_2(s)\left|\begin{matrix}AgCl\ 20\ M\%\ (s)\\ NaCl\end{matrix}\right|Ag$$

where the overall cell reaction is $Ce + AgCl(NaCl) = CeCl_3 + Ag$. When possible, cells were constructed so that adjacent phases exhibited negligible mixing as shown by the phase diagrams. In this way junction potentials were eliminated. The effect of metal-salt reactions (subhalide formation) on the cell behavior is discussed. The experimental techniques used are presented, including cell construction, preparation of anhydrous materials, and the handling of reactive metals and hydroscopic materials for galvanic cells. Results of ΔG^0 of formation are presented for $MgCl_2$, $CeCl_3$, UCl_3, and $ThCl_4$, and are compared with other available data. (auth)

7990 (BNL-6159) ISOTOPE EFFECTS ON INTERMOLECULAR INTERACTIONS AND ISOTOPIC VAPOR PRESSURE DIFFERENCES. Max Wolfsberg (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 23p.

The isotope effect on the van der Waals interaction resulting from vibrational excitation terms is discussed to show that it is a zero-point energy effect. Interaction between rotational, translational, and vibrational motion in the condensed phase is also discussed in terms of a simple model. By the use of approximation methods, the order of magnitude of these effects is demonstrated and it is shown that consideration of them is of importance in connection with vapor pressure isotope effects. Some other origins of vapor pressure isotope effects are cursorily discussed. (auth)

7991 (BNL-6583) THE Mg–$MgCl_2$ SYSTEM—A CHRONOPOTENTIOMETRIC STUDY. John D. Van Norman and James J. Egan (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT-30-2-GEN-16]. 9p.

The mode of dissolution of magnesium in molten magnesium chloride contacted with Mg-Pb alloys was studied at 750°C using anodic chronopotentiometry. An inert tantalum anode was used to determine relative amounts of magnesium dissolved in its chloride as a function of magnesium activity in the alloy. According to the law of mass action a linear dependence of magnesium solubility on a_{Mg} indicates Mg_2Cl_2 as the reaction product and a parabolic dependence indicates MgCl. It was found that the amount of magnesium dissolved in its chloride was directly proportional to the magnesium activity in the metal phase, i.e., a linear dependence, indicating Mg_2Cl_2 as the subhalide species. Due to the corrosive nature of the Mg-$MgCl_2$ system a special apparatus was used so that only the inert metals tantalum and molybdenum came in contact with the melt. Purification procedures and conditions for proper equilibration and measurement were established and are reported. The basic equation of chronopotentiometry, $i\tau^{1/2} = nF\pi^{1/2}D^{1/2}C/2$, was found to hold and at given magnesium activities the product $i\tau^{1/2}$ did not vary with the current, indicating the validity of the analytical technique. The diffusion coefficient of the Mg_2^{2+} ion was calculated and found to be 5.3×10^{-6} cm^2/sec at 750°C. (auth)

7992 (BNL-6589) THERMODYNAMICS OF FUSED SALT MIXTURES FROM EMF MEASUREMENTS. THE SYSTEMS NaCl–KCl, NaCl–$MgCl_2$, AND NaCl–$CeCl_3$. James J. Egan and John Bracker (Brookhaven National Lab., Upton, N. Y.). Dec. 20, 1962. Contract [AT-30-2-GEN-16]. 6p.

The following cells were operated at 820°C: (p = 1 atm) $Cl_2(g) - C|NaCl(l)|^{Porcelain}_{(Na^+)}|^{NaCl}_{KCl}(l)|C - Cl_2(g)$ (p = 1 atm), (p = 1 atm) $Cl_2(g) - C|NaCl(l)|^{Porcelain}_{(Na^+)}|^{NaCl}_{MgCl_2}(l)\ C - Cl_2(g)$ (p = 1 atm), and (p = 1 atm) $Cl_2(g) - C|NaCl(l)|^{Porcelain}_{(Na^+)}|^{NaCl}_{CeCl_3}(l)|C - Cl_2(g)$ (p = 1 atm) where the overall reaction in each cell is simply the transfer of NaCl from pure NaCl to the mixtures of the right hand compartment.

The porcelain acts as a pure sodium ion conductor in these cells. The relative partial molar free energy of mixing for sodium chloride, F^M_{NaCl}, is then given by $F^M_{NaCl} = -\mathcal{F}E$ where E is the EMF of the cell. Results are given over the entire composition range in each system and compared with previous measurements from other sources. Other thermodynamic quantities were calculated from the results. Experiments using a H_2, HCl mixture in place of Cl_2 are discussed, as well as the extension of the measurements to other systems. (auth)

7993 (GAT-T-971) HEXAFLUORIDES OF MOLYBDENUM, TUNGSTEN AND URANIUM. III. REACTIONS WITH NITROGEN DIOXIDE AND NITROGEN OXYHALIDES. J. R. Geichman, L. R. Swaney, and P. R. Ogle (Goodyear Atomic Corp., Portsmouth, Ohio). Feb. 20, 1962. Contract AT(33-2)-1. 9p.

Reaction between gaseous nitrogen dioxide and gaseous uranium hexafluoride gave NO_2UF_6. The same compound resulted when uranium pentafluoride and nitryl fluoride reacted. Reaction between nitrosyl and nitryl fluorides and the three hexafluorides results in solid compounds of the composition $NO_xF \cdot MF_6$. Reaction between nitrosyl chloride and molybdenum and uranium hexafluorides formed the nitrosylium salts $NOMoF_6$ and $NOUF_6$, and liberated chlorine. (auth)

7994 (IS-443) TRANSFERENCE NUMBERS AND ION ASSOCIATION IN PURE FUSED ALKALINE EARTH CHLORIDES. Edward D. Wolf and Frederick R. Duke (Ames Lab., Ames, Iowa). [Mar. 27, 1962]. Contract [W-7405-eng-82]. 12p.

The transference number of the chloride ion was determined in pure fused $MgCl_2$, $CaCl_2$, $SrCl_2$, and $BaCl_2$ utilizing radioactive chloride ions in a porous quartz membrane cell. On the basis of a two-step dissociation for these salts, $MCl_2 \rightleftharpoons MCl^+ + Cl^- \rightleftharpoons M^{++} + 2Cl^-$, the extent of the second dissociation was qualitatively predicted from a consideration of the relative mobilities of the ions. (auth)

7995 (IS-507) A FORTRAN PROGRAM FOR DETERMINING THE THERMAL DIFFUSIVITY OF FINITE LENGTH SAMPLES. Paul Dean Maycock (Ames Lab., Ames, Iowa). Sept. 1962. Contract W-7405-eng-82. 16p.

A FORTRAN program was written which will make it possible to analyze thermal diffusivity data on the IBM 704. The first description of the physics and mathematics of the method was made by Kennedy. The linear heat flow equation was solved by the method of finite differences. Temperature versus time curves were obtained at three equally spaced points along a finite cylindrical rod. The curves obtained at the two outer points were used as boundary conditions for the finite difference calculus, and the diffusivity was determined by finding the computed solution which gave the best fit to the experimental data obtained at the midpoint. The program has improvements which prevent the computer from calculating false values for the diffusivity, can operate with any of six preselected mesh sizes, and takes advantage of the capacity of the IBM 704. (auth)

7996 (MATT-148) DETERMINATION OF DIFFUSIVITY AND SOLUBILITY IN TWO PHASE SYSTEMS. F. W. Camp and E. F. Johnson (Princeton Univ., N. J. Plasma Physics Lab.). Sept. 1962. Contract AT(30-1)-1238. 35p.

A method for determining diffusivity and solubility in two-phase systems was developed. The method involves following the concentration of the diffusing component, or sorbate, in response to a step change in that concentration in a system in which total volume and temperature are constant. Both solubility and diffusivity of the sorbate in the solvent, or sorbent, are determined simultaneously in a single experiment. The method is applicable to solid or liquid sorbent phases. The sorbate may be gas or liquid. Equations are presented for analysis of experimental data. (M.C.G.)

7997 (NP-12377) MOLECULAR STRUCTURE AND PHYSICAL BEHAVIOR OF POLYMERS. Progress Report No. 9, August 1, 1962–October 31, 1962. Maurice Morton and A. N. Gent (Akron, Ohio. Univ. Inst. of Rubber Research). Dec. 5, 1962. Contract AF33(616)-6965. 24p.

Stress-temperature relations were investigated for linear polyethylene, crosslinked to varying extents by gamma irradiation, and subjected to elongations of varying amount. The incipient crystallization temperature T_c was found to be reduced only slightly (by about 6°C) over the range of crosslinking employed, in measurements at small extensions. The application of moderate extensions brought about somewhat larger increases in T_c. The increase was larger for the more highly crosslinked materials, so that a reversal of the T_c values appeared to occur at extensions of about 250%. Stress changes on crystallization under isothermal conditions were also examined. Stress increases were observed, confirming that they are not due solely to thermal contraction. Experimental deficiencies in the stress measurements are being studied to permit further quantitative work. Stress-temperature relations were also determined for crosslinked balata. Clear indications of the melting of the β crystal form were obtained; they suggest that both crystal forms can occur in oriented "bundle" crystallites. The stress rise on crystallization was not so pronounced in the crosslinked balata. It was found to be completely eliminated by a partial melting, before recrystallization. (auth)

7998 (NP-12391) A NEW METHOD FOR DETERMINING THE STABILITY CONSTANTS OF SUCCESSIVE COMPLEXES. T. Erben (European Company for the Chemical Processing of Irradiated Fuels, Mol., Belgium). Jan. 11, 1961. 9p. (ETR-96)

A new procedure for calculating the stability constants of successive complexes is described. This method takes advantage of the fact that the complex-formation curve may be represented adequately by an empirical polynomial if the equilibrium constants involved are not excessively large. The stability constants are simply related to the coefficients of this polynomial which are determined by the method of least-squares. This procedure is superior to the conventional method of successive extrapolations of Fronaeus, since it does not introduce cumulative errors. Moreover, in the new method, the whole range is involved in the calculation of each constant, in contrast to the Fronaeus method where the extrapolated values are relatively independent of the experimental points situated far from the extrapolation region. The method is applied to the uranyl-mono-chloroacetate system. (auth)

7999 (NP-12432) HEAT CAPACITY OF LIQUID ALLOYS. Final Report. Raymond L. Orr and Ralph Hultgren (California. Univ., Berkeley). Dec. 15, 1962. Contract Nonr-222(63). 6p.

The results of the research program on the heat capacities of liquid metals and alloys are reviewed briefly. The measurements were made in a modified liquid tin solution calorimeter, and the general trends of the data for tin, bismuth, indium, and indium–tin alloy are described. (D.L.C.)

8000 (ORNL-TM-440) TRANSPORT PROPERTIES OF DISSOCIATING GASEOUS MIXTURES. Charles S. Shoup, Jr. (Oak Ridge National Lab., Tenn.). Dec. 18, 1962. Contract [W-7405-eng-26]. 26p.

The effects of various parameters on the transport properties of dissociating gaseous mixtures were studied. In order to take advantage of the increase in thermal conductivity and specific heat due to the dissociation, the heat of dissociation must be "large," the molecular weight and molecular volume must be small, and both associated and dissociated molecules must be present in appreciable amounts at reasonable temperatures. Very few dissociation reactions meet all of these requirements. In order to illustrate the effects of dissociation on many properties, estimates were made for the thermal conductivity, specific heat, specific volume, and viscosity of helium–aluminum chloride and helium–fluorine mixtures as a function of temperature at various pressures and compositions. The maxima in the thermal conductivity and specific heat curves, which are due to the heat of dissociation, can be varied over a wide range of temperatures by controlling the pressure and helium concentration. The dissociation produces a greater than linear increase in specific volume with increasing temperature. According to the calculations, a helium–fluorine mixture has a thermal conductivity and specific heat which can be as much as a factor of two greater than the corresponding values for pure helium, while the viscosity of the mixture is approximately 10% greater than that of helium and is only slightly dependent on composition. The thermal properties and viscosity of helium–aluminum chloride mixtures are considerably less than those of pure helium. (auth)

8001 (PAN-335/IX) STATISTICAL INTERPRETATION OF THE SATURATION MAGNETIC MOMENT AT 0°K OF $Zn_xMe_{1-x}Fe_2O_4$ FERRITES. Andrzej Murasik and Zbigniew Weiss (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1962. 17p.

The dependence of the saturation magnetic moment of mixed–ferrites $Zn_xMe_{1-x}Fe_2O_4$ at 0°K on nonmagnetic Zn ions concentration was interpreted by means of statistical methods. The method was illustrated on a model of linear Ising lattice, in the case of which it was possible to find an exact result. (auth)

8002 (PAN-338/IV) STUDIES ON THE KINETICS AND MECHANISM OF UO_2 OXIDATION IN SODIUM SULPHATE SOLUTION AND IN PRESENCE OF SILVER ION. Tadeusz Adamski and Danuta Szymańska (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1962. 9p.

Kinetics of dissolution of UO_2 in sodium sulfate solution in the presence of argenteous ions has been investigated. Reaction velocity constants for different pH values within the range 2.65 to 3.75 and at temperatures of 20°C and 90°C have been determined. The energy of activation at the specified pH values has been calculated. (auth)

8003 (RT/CNI(62)4) PRODUCTION OF A STEADY-STATE EXCESS IONIC CONDUCTIVITY DURING PLASTIC DEFORMATION OF ALKALI HALIDES. P. Camagni and A. Manara (Italy. Comitato Nazionale per l'Energie Nucleare. Centro di Studi Nucleari, Ispra). June 1962. 19p.

The steady-state enhancement of ionic conductivity, which is attained during progressive flow at a rigorously controlled rate, was measured in a variety of conditions on crystals of KCl and KBr. The excess conductivity was investigated with reference to: dependence on strain rate, at fixed temperature and dependence on temperature, at fixed rate. The mode and the rate of annealing of the excess conductivity after deformation were also investigated. It was found that the annealing is bimolecular in the main, though with some complications. The results on the dependence on strain rate and temperature are discussed in a simple scheme of defect kinetics. (auth)

8004 (TID-14716) STABILITY CONSTANTS OF CERTAIN LANTHANIDE(III) AND ACTINIDE(III) CHLORIDE AND NITRATE COMPLEXES. D. F. Peppard, G. W. Mason, and I. Hucher (Argonne National Lab., Ill.). Nov. 1961. Contract [W-31-109-eng-38]. 13p. (UAC-5777)

Extraction of trivalent lanthanides and actinides from mixed perchlorate-chloride and perchlorate-nitrate aqueous phases was used to determine the stability constant for trivalent lanthanide and actinide chlorides and nitrates. A monoacidic ester of orthophosphoric acid in toluene as a carried diluent was used to extract the metal ions from the aqueous phase. (M.C.G.)

8005 (TID-15554) THERMOCHEMICAL STUDIES AT ARGONNE NATIONAL LABORATORY. Ward N. Hubbard (Argonne National Lab., Ill.). Feb. 1962. Contract [W-31-109-eng-38]. 5p. (UAC-6084)

Activities in a program to obtain thermodynamic data on compounds of interest in high-temperature chemistry are reported. Recent determinations were made concerning the heats of formation of UN, ZrH_2, and ZrD_2 using oxygen bomb calorimetry. Other results obtained by fluorine bomb calorimetry on TiF_4, HfF_4, and SiF_4 are also reported. (J.R.D.)

8006 (TID-16040) MEASURED BEHAVIOR OF GAMMA-RAY PHOTOCONDUCTIVITY IN ORGANIC DIELECTRICS. S. E. Harrison (Sandia Corp., Albuquerque, N. Mex.). June 1962. Contract [AT(29-1)-789]. 20p. (SCDC-2685; SCR-526)

Photoconductivity measurements are reported for polyethylene, polystyrene, a mica-filled epoxy formulation, polypropylene, nylon, Teflon, diallylphthalate, and H-film. The measurements were made at gamma intensities within the interval from 1.0×10^{-3} rads(H_2O)/sec to 1.0×10^{4} rads (H_2O)/sec and at temperatures which ranged from 38 to 71°C. Conductivity was found to have distinct features in three time intervals denoted as A, B, and C. In interval A conductivity responded to a step increase in gamma intensity. This response was exponential in nature with the time constant decreasing with increased gamma intensity. The change in time constant (τ_θ) as a function of gamma intensity (γ) at a fixed temperature is approximated by $\tau_\theta = B\gamma^{-\mu}$, where B and μ are empirical constants. In interval B the photoconductivity ($\sigma-\sigma_\theta$) reached an equilibrium value whose magnitude as a function of gamma intensity at a fixed temperature was characterized to good approximation by $(\sigma-\sigma_\theta) = A\gamma^{\delta}$, where A and δ are empirical constants. In interval C the conductivity recovered upon sample removal from the gamma environment. The measured photoconductivity decay can be characterized by $\sigma = \sigma_{eq}\sum_{i=1}^{n} A_i e^{-t/\tau_i}$, where σ_{eq} is the equilibrium conductivity of interval B defined by $\sigma_{eq} = \sigma_\theta + A\gamma^{\delta}$, the τ_i's are discrete decay time constants of the recovery, the coefficients, A_i, are the weighting factors associated with the i^{th} decay time constant, and n is the number of discrete decay time constants in the recovery process. (auth)

8007 (TID-17667) A JAHN-TELLER EFFECT IN THE E_g VIBRATIONAL MODE OF HEXAFLUORIDE MOLECULES; THE INFRARED SPECTRA OF RuF_6 AND RhF_6. Bernard Weinstock (Ford Motor Co., Dearborn, Mich.); Howard H. Claassen, and Cedric L. Chernick (Argonne National Lab., Ill.). Oct. 1962. Contract [W-31-109-eng-38]. 27p. (UAC-6978)

The infrared spectra of RuF_6 and RhF_6 are reported and are interpreted in terms of a regular octahedral structure. The spectra for RuF_6 showed fewer bands than any of the known hexafluoride molecules, presumably owing to a Jahn-Teller effect. The fundamental vibrational frequencies

(cm^{-1}) for RuF_6 were ν_1, 675; ν_3, 735; ν_4, 275; ν_5, 262; for RhF_6, ν_1, 634; ν_2, 595; ν_3, 724; ν_4, 283; ν_5, 269; ν_6, 192. The missing frequencies for RuF_6 were estimated to be: ν_2, 570, ν_6, 210. A broad band arising from an electronic transition in RuF_6 was also observed with maxima at 1400 and 1950. Evidence for a J-T effect in the E_g mode for hexafluoride molecules is reviewed. Comparison of band widths for ($\nu_1 + \nu_3$) and ($\nu_2 + \nu_3$) permitted the following estimates of J-T splittings (cm^{-1}) for the E_g mode: TcF_6, 80; ReF_6, 25; OsF_6, 54. RhF_6, like IrF_6, did not show a J-T effect of comparable magnitude, presumably because of the "spin character" of its electronic ground state. The corresponding effect for RuF_6 was larger and could not be similarly evaluated because the band ($\nu_2 + \nu_3$) is so broadened as to prevent its characterization. (auth)

8008 (TID-17673) TECHNICAL PROGRESS REPORT NO. 2189 AND NO. 2190 [ON MOLTEN SALTS]. (New York Univ., New York). Jan. 7, 1963. Contract AT(30-1)-1938. 55p.

The conductance of $AgNO_3$ and $TlNO_3$ was determined in conventional semi-capillary cells and in cells with medium pyrex fritted discs over the temperature range 214 to 318°C. The conventional specific conductances agreed reasonably well with previous results. For $TlNO_3$ the temperature range was extended to 318° from 250°. The specific conductance through fritted discs below 280° was the same as the conventionally determined one for $AgNO_3$ and about 5 to 8% lower than the conventionally determined one for $TlNO_3$. Above 280° there was an increase in the apparent specific conductance (about 25%) for both salts. This was tentatively attributed to a change in the cell constant, through a decrease in the electrical resistance of the glass. The viscosities of $AgNO_3$ and $TlNO_3$ were determined in Ostwald viscosimeters over the same temperature range as the conductivities. The absolute values of the viscosity of $AgNO_3$ differed from the literature values by 5 to 10%; the range of the $TlNO_3$ viscosity determinations was extended from 250 to 318°C. The "apparent activation energies" for the conductance were constant for both salts over the whole temperature range and equal to 3.0 kcal, while the apparent activation energies for the viscosity varied from 4.1 at 220°C to 2.4 kcal at 300°C for $AgNO_3$ and from 3.8 at 220°C to 2.8 at 300°C for $TlNO_3$. (auth)

8009 (TID-17687) EVALUATION OF FERRITE MATERIALS FOR POSSIBLE APPLICATION IN THE PRINCETON-PENNSYLVANIA 3 Bev PROTON SYNCHROTRON. Moore School Report No. 58-05. Pietro P. Lombardini, Richard R. Schwartz, and Richard J. Doviak (Pennsylvania. Univ., Philadelphia. Moore School of Electrical Engineering). July 1, 1957. Contract [AT(30-1)-1916]. 127p.

The properties of ferrite material to be used in the 3-Bev proton synchrotron at Princeton were investigated. Measurements of demagnetized rings, determination of quality factor vs r-f flux, measurements of rings under magnetic bias, and dielectric parameter measurements are given. The behavior of ferrites at radio frequencies was determined, including magnetic and dielectric properties. (M.C.G.)

8010 (TID-17767) THE THERMAL CONDUCTIVITY OF INORGANIC MELTS. Annual Report. W. O. Philbrook (Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.). Dec. 15, 1962. Contract AT(30-1)-2360. 39p.

The thermal conductivities of molten Ag_2S and Ni_3S were determined. The thermal conductivity apparatus was a concentric-cylinder, steady-state device, and the test liquid was confined in an annular gap between concentric graphite cylinders. All final measurements of temperature and of power input to the test section were made with a potentiometer. The interface temperatures were obtained by a short extrapolation of the temperature profiles in the graphite on either side. Four thermocouples with their hot junctions located along a common radius in the mid-plane of the test section. The mean thermal conductivity of the sample was calculated from an equation obtained by integration of Fourier's first law for radial heat flow in an infinite cylinder. The maximum error that could be accounted for by quantitative estimation is of the order of 4 to 9%. Values obtained for Ag_2S averaged about 30×10^{-4} cal/cm sec °C and for Ni_3S averaged about 0.050 cal/sec cm °C. (M.C.G.)

8011 (UCRL-6893) LATTICE DYNAMICS AND SPECIFIC HEAT DATA FOR ROCKSALT STRUCTURE ALKALI HALIDES. Arnold M. Karo and John R. Hardy (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 18, 1962. Contract W-7405-Eng-48. 84p.

Vibrational distribution functions are derived for a number of rocksalt-structure alkali halides using a more refined treatment of the interionic forces than that provided by regarding them as rigid point charges. The dipole moment at any given ion site is calculated taking into account the contribution from the deformation of the electron distribution resulting from both polarization and overlap repulsion between nearest neighbors. In this way the dipole-dipole part of the Coulomb interaction is treated self-consistently. Both room-temperature and 0°K input parameters are used, and the derived specific heat data are compared with experimental results. The over-all agreement with experiment is significantly better than that obtained by treating the ions as rigid point charges. Sets of phonon dispersion curves are also given. For NaI they are in much better agreement with those determined experimentally by inelastic neutron scattering than are the rigid ion curves. There appears to be close agreement with the results of the "shell model" calculations. (auth)

8012 (UCRL-6945-T) THE HEAT OF SOLUTION OF HYDROGEN CHLORIDE. Stuart R. Gunn and LeRoy G. Green (California. Univ., Livermore. Lawrence Radiation Lab.). June 4, 1962. Contract [W-7405-Eng-48]. 3p.

The heat of solution of hydrogen chloride was determined. The HCl was prepared by reaction of NaCl with H_2SO_4 and purified by passage over finely divided uranium prepared by decomposition of UH_3. The average value obtained from 5 runs was $-17,888 \pm 0.014$ kcal $mole^{-1}$. (M.C.G.)

8013 (UCRL-10105) PURIFICATION OF MgF_2 AND GROWTH OF SINGLE CRYSTALS. William D. Scott (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 2, 1962. Contract W-7405-eng-48. 14p.

A modified Bridgman-Stockbarger method was used to grow single crystals of MgF_2 weighing about 200 gms. The purity of the charge material was critical. Purification was achieved by first drying technical grade MgF_2 and then vaporizing in vacuum. Spectral transmission of the single crystals was measured: in comparison with CaF_2, MgF_2 was slightly less transparent in the infrared region and had about the same transparency in the ultraviolet region. Modulus-of-rupture values were also obtained in several orientations. No plastic flow was observed. (auth)

8014 (UCRL-10141) VAPOR PRESSURE AND HEAT OF SUBLIMATION OF CALCIUM FLUORIDE. David A. Schulz and Alan W. Searcy (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). Mar. 29, 1962. Contract W-7405-eng-48. 16p.

The vapor pressure of CaF_2 was investigated in the temperature range 1400 to 1850°K by the torsion-effusion method. Molecular-streaming conditions were demonstrated to break down when the mean free path became about as short as the orifice diameter, but a dependence on orifice channel length was observed. The vapor pressure (in atmospheres) of β-CaF_2 is given by the equation Log P = −19,973/T + 7.8717 in the experimental range. Extrapolation yields a calculated normal boiling point of 2786°K and a heat of sublimation at 298°K of 101.2 kcal by the third-low method and 101.4 by the second-low method. (auth)

8015 (UCRL-10497) THE EFFECT OF HYDROSTATIC PRESSURE ON THE LOW-TEMPERATURE THERMOLUMINESCENCE OF NaCl (thesis). William V. Macnabb (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 9, 1962. Contract W-7405-eng-48. 26p.

The effect of hydrostatic pressures up to 10,620 atm. on the low-temperature glow curve of NaCl was measured. It was found that one glow peak is enhanced by pressure in the range of conditions studied. It is proposed that this enhancement is caused by the production and movement of dislocations within the crystal lattice. This movement creates vacancies and interstitials which will affect the luminescence. The experimental procedure consisted of irradiating single crystals of NaCl with a Co^{60} source at liquid nitrogen temperature. After irradiation, the crystal was heated and the subsequent glow was recorded by a photomultiplier tube. The crystal was then pressed hydrostatically for a period of time, and the above procedure was repeated. A comparison was made between the glow curves obtained before and after pressing the crystal to determine what effect pressure had on the luminescence. (auth)

8016 (AEC-tr-5601) SOLUBILITY OF TITANIUM, ZIRCONIUM, AND HAFNIUM OXIDES IN MOLTEN ALKALI METAL FLUORIDES. Yu. K. Delimarskiĭ and G. G. Buderaskaya. Translated by C. B. Finch (Oak Ridge National Lab.) from Ukr. Khim. Zh., 28: 565-70(1962). 9p.

The solubilities of TiO_2, ZrO_2, and HfO_2 in LiF, NaF, and KF were determined at 1000, 1100, and 1200°C, using the isothermal saturation method. The solubilities decrease in the order $TiO_2 > ZrO_2 > HfO_2$, with HfO_2 being practically insoluble; the order is as predicted by Shreder's equation. The solvent properties of the fluorides increase in the order LiF < NaF < KF; the order is the reverse of that predicted by Semenchenko's rule. (D.L.C.)

8017 (EURAEC-484) APPLICATION OF TRANSITORY ELECTROCHEMICAL METHODS TO THE CHEMICAL ANALYSIS OF PRODUCTS CONCERNING NUCLEAR CHEMISTRY. Quarterly Report No. 3, July 1–September 30, 1962. (Brussels. Universitè). Work Performed under United States–Euratom Joint Research and Development Program. Contract 018-60-RDB. 16p. A translation.

The study of the electrochemical behavior of uranium in its valencies VI and V in a carbonate medium was pursued. In disagreement with previous work, it was proved that the phenomena of hydrolysis are not the determining factors of the reaction kinetics over a fairly wide pH range (pH 7 to 12.5). It was found on the contrary that the double-layer effects, and more particularly those connected with the adsorbability of the supporting cation, have a considerable influence on the behavior. The reduction to the Uranium(VI) stage exhibits certain peculiarities which are connected to the occurrence of a process of autocatalytic nature. The carbonate complex of Uranium(V) is perfectly stable in a sufficiently alkaline medium, and only tends to undergo "dismutation" at an appreciable rate at pH values smaller than 8. On account of its interest from the analytical point of view, this reaction is being subjected to a quantitative study. On the other hand, the investigation into the kinetic current observed in an acid medium in the presence of accelerating anions has been pursued. The influence of the oxalate is quite important and can therefore find some analytical applications in more strongly oxidizing media. (auth)

8018 REACTIONS OF RARE EARTH ELEMENTS WITH SOME POLYHYDROXYFLAVONES. T. Nowicka-Jankowska, H. Szyszko, and J. Minczewski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Acta Chim. Acad. Sci. Hung., 33: 135-41(1962). (In English)

The influence of polyhydroxyflavone structures on complex formation was studied. The hydroxyl group in position 3 combined with the carbonyl group in position 4 were found to be responsible for forming complexes with lanthanides. The differences in the spectra of particular lanthanide complexes and possibilities of their analytical use were investigated. The formation of the mixed complexes polyhydroxyflavone–lanthanide–pyridine was established. (auth)

8019 SOME REACTION KINETICAL PROBLEMS OF THE DECONTAMINATION OF WATERS BY ION-EXCHANGE. A. Almásy and G. Almásy (Research Inst. for Heavy Chemical Industries, Veszprem, Hungaria and Hungarian Oil and Gas Research Inst., Veszprem). Acta Chim. Acad. Sci. Hung., 33: 471-81(1962). (In English)

On the basis of the experimental evidence, it was proved that the evolved method of investigation is suitable to furnish all data necessary for planning equipment for the decontamination of waters by ion exchange, and that it is suitable for elucidating the dependence of this reaction on temperature as well. The measurements of the kinetics of the examined reactions yielded valuable data of the overall process which at the same time point to the complex nature of the reaction mechanism. Other investigations elucidating these phenomena also from other aspects are still needed in order to completely clear up the mechanism. (auth)

8020 INVESTIGATIONS OF ION-EXCHANGE EQUILIBRIA WITH RADIOACTIVE TRACER METHOD. V. INVESTIGATIONS ON ION-EXCHANGE EQUILIBRIA IN THE QUATERNARY SYSTEM Cs–Rb–Na–H. T. Lengyel and Á. Jász (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest). Acta Chim. Acad. Sci. Hung., 34: 19-28(1962). (In English)

Investigations were carried out on the equilibrium of the quaternary model-system Cs–Rb–Na–H, which is important from the point of view of decontaminating radioactive wastes. The relations between the compositions of the initial solution and those after equilibrium were experimentally determined. Dealing the quaternary system as a pseudoternary one, a graphical method was elaborated for the determination of quaternary equilibrium starting out from pseudobinary (ternary) equilibrium data. (auth)

8021 INVESTIGATIONS ON ION-EXCHANGE EQUILIBRIA WITH RADIOACTIVE TRACER METHOD. VI. INVESTIGATIONS CONCERNING THE ION-EXCHANGE EQUILIBRIA OF THE SYSTEM Cs–Na–H IN ALCOHOLIC MEDIA. T. Lengyel (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest). Acta. Chim. Acad. Sci. Hung., 34: 29-33(1962). (In English)

Investigations were carried out to determine ternary equilibrium data in alcohol–water mixtures and in pure alcoholic medium. It was stated that the mass action quotient relating to the equilibrium increases with the alcohol contents; when plotting the equilibrium values obtained in the

diagram suggested by Yamabe and Sato, a straight line is to be obtained. In the course of the investigations the constants of the equations for the lines representing the different alcohol concentrations were determined. (auth)

8022 ELECTROMETRIC STUDY OF THE SYSTEM LANTHANUM–MOLYBDATE AND THE FORMATION OF POLYMOLYBDATES. Ram Sahai Saxena and Mohan Lal Mital (Government Coll., Kota, India). Acta Chim. Acad. Sci. Hung., 34: 193-201(1962). (In English)

The course of reaction between lanthanum nitrate and different alkali molybdates (normal, di-, para-, tri-, and meta-) was followed by means of glass electrode titrations between the reactants at different pH ranges, in aqueous and alcoholic media, with each of the reagents alternately used as titrant. Electrometric experiments provide definite evidence of the formation of normal lanthanum molybdate $La_2O_3 \cdot 3\ MoO_3$ at pH range 5 to 6 and para-molybdate $La_2O_3 \cdot 7\ MoO_3$ at pH range 3.5 to 4.5. The formation of normal molybdate is almost quantitative and the pH titrations offer a simple means for the determination of lanthanum or molybdate solutions at suitable concentrations and pH ranges. H^+ plays an important role in the aggregation process. (auth)

8023 ON THE CATALYTIC PROPERTIES OF CERIUM(IV) AND CERIUM(III) IONS IN THE DECOMPOSITION REACTION OF CARO'S ACID. L. J. Csányi and I. Domonkos (Univ. of Szeged). Acta Chim. Acad. Sci. Hung., 34: 383-7(1962). (In German)

It was found that the decomposition of Caro's acid is vigorously catalyzed by cerium(IV) and cerium(III) ions. This takes place in a way that cerium ions form a complex with peroxysulfuric acid, and thus significantly loosen the –O,O– bond of the substrate. (auth)

8024 SPONTANEOUS POLARIZATION OF SOME $(Na,K)NbO_3$ CERAMICS. Rodman D. Golding, Robert H. Dungan, and Basil Ohnysty (Sandia Corp., Albuquerque, N. Mex.). Appl. Phys. Letters, 1: 2-3(Sept. 1962). (TID-15760)

Measurements of spontaneous and remanent polarizations of $(Na,K)NbO_3$ materials near the antiferroelectric boundary are made to provide needed information. Spontaneous polarization of about 30 μcoulombs/cm^2 is obtained from hysteresis measurements. Values obtained are reasonable considering usual ferroelectric behavior. (D.C.W.)

8025 FERROMAGNETISM IN DIVALENT EUROPIUM SALTS. T. R. McGuire, B. E. Argyle, M. W. Shafer, and J. S. Smart (IBM Research Center, Yorktown Heights, N. Y.). Appl. Phys. Letters, 1: 17-18(Sept. 1962).

Some divalent europium compounds (EuS, EuSe, EuTe) are made by formerly used procedures, and their magnetic properties are examined and compared with EuO characteristics. At 4.2°K, the sulfide and selenide are ferromagnetic and the telluride is paramagnetic. Graphs display various temperature and magnetic variations. (D.C.W.)

8026 VARIATION OF SOUND VELOCITY AT $Fe_1 - Fe_2$ TRANSITION IN $PbZr_{.95}Ti_{.05}O_3$. D. G. Doran and R. Goettelman (Stanford Research Inst., Menlo Park, Calif.). Appl. Phys. Letters, 2: 22(Jan. 1, 1963). (TID-16902)

Sound velocity measurements made on $PbZr_{.95}Ti_{.05}O_3$ give further evidence for a new phase transition in the ferroelectric lead zirconate–lead titanate system. Longitudinal wave velocity is measured using a null technique for measuring pulse-transit times. Data reveal an abrupt longitudinal sound velocity increase between 70 and 80°C. (D.C.W.)

8027 EXPERIMENTAL DETERMINATION OF THE HYDROGEN RECOMBINATION CONSTANT. Arthur Widawsky, Lawrence R. Oswalt, and James L. Harp, Jr. (Marquardt Corp., Van Nuys, Calif.). ARS (Am. Rocket Soc.) J., 32: 1927-9(Dec. 1962).

An analytical and experimental investigation is performed to determine the value of the hydrogen recombination rate constant at operating conditions applicable to a hydrogen-propelled arc-jet engine. Two analytical techniques for the analysis of the experimental data are used, one an approximate method employing the incidence of chemical freezing, and the second an exact solution of the nonequilibrium expansion. The approximate solution gives essentially the same results as the exact solution. The experiment is conducted using two conical, axially symmetric exhaust nozzles, each having an expansion area ratio of 40 : 1 but one having five times the geometric expansion rate of the other. The tests are conducted over a range of inlet total pressures from 0.8 to 2.5 atm. and over a range of inlet total temperatures from 6200 to 7800°R. Values of the hydrogen recombination rate constant are found to range from 2×10^{16} to 2×10^{17} cm^6/mole^2-sec. (auth)

8028 COMPOSITION OF GASES PRODUCED BY THE INTERACTION OF URANIUM DIOXIDE WITH NITRIC ACID. E. A. Kanevskiĭ, A. P. Filippov, and N. V. Timofeeva. At. Energ. (USSR), 13: 484-6(Nov. 1962). (In Russian)

In the leaching of U ores by H_2SO_4, nitric acid is used as an oxidizing agent, but the composition of the gaseous reaction products formed by the reduction of HNO_3 was not studied in the past. This problem was experimentally investigated by reacting UO_2 with HNO_3 in a sulfuric acid solution in an autoclave at 85°C. The acid used was previously purified, removing all nitrous impurities by blowing air through it after distillation. Analysis of the gas phase indicated that the main reaction product under the experimental conditions used was NO; only <0.3 vol. % N_2O and <1.9 vol. % NO_2 were found in the gas phase. (TTT)

8029 THERMODYNAMIC PROPERTIES OF URANIUM (III) CHLORIDE IN DILUTED SOLUTIONS OF THE MELTED EUTECTIC MIXTURE LiCl–KCl. A. Kisza and W. Trzebiatowski (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw). Bull. Acad. Polon. Sci., Ser. Sci. Chim., 10: 387-93(1962). (In English)

Thermodynamic properties of UCl_3 in dilute solutions of LiCl–KCl, using a galvanic cell equipped with a reversible chlorine electrode, were determined. The results are tabulated. (P.C.H.)

8030 MOLECULAR SPECTROSCOPY OF ANHYDROUS URANYL SALTS. III. SPECTROSCOPIC CHARACTERISTICS OF ANHYDROUS AND HEXAHYDRATE URANYL NITRATE. B. Jeżowska-Trzebiatowska, A. Bartecki, and B. Kedzia (Department of Inorganic Chemistry, Technical Univ., Warsaw). Bull. Acad. Polon. Sci., Ser. Sci. Chim., 10: 433-8(1962). (In English)

A comparison was made of the absorption spectra of hexahydrate and anhydrous uranyl nitrate in dioxane, acetone, and formamide, and it was found that the transition energies change in a characteristic manner. Hypsochromic shifts occurred in going from the hydrated to the anhydrous salt, the largest in dioxane amounting to 538 cm^{-1}. The vibrational structure was the most distinct and the determination of band positions the most exact in acetone. Therefore it was concluded that in solvents with distinct vibrational structure water exerts only a very small influence on the relative position of the potential energy curves in the gound and excited states. The intensity distribution in the anhydrous salt spectrum was generally identical with that of hexahydrated uranyl nitrate. The results on anhydrous uranyl nitrate confirmed the calculation of the totally sym-

metric vibrations ν_1 as arithmetic mean values of the intervals between the adjacent vibrational bands. (P.C.H.)

8031 THE HIGH-TEMPERATURE OXIDATION KINETICS OF ZIRCONIUM. K. H. Akram and W. W. Smeltzer (McMaster Univ., Hamilton, Ont.). Can. Met. Quart., 1: 41-57(July-Sept. 1962).

An investigation of the parabolic-linear oxidation of zirconium at 800 and 850°C is reported. It was found that irrespective of the oxygen concentration in the metal substrate, parabolic kinetics represent the growth of the initial compact oxide scale while linear kinetics represent the later stages of growth. Metallographic observations indicated a transition from a compact to compact plus porous oxide scale. Accompanying hardness measurements demonstrated that oxygen penetrated into the metal via a steady concentration profile during linear oxidation. An exponential solution of the diffusion equation fitted to the concentration profile gave evaluations of the oxygen diffusion constant in the metal which are in good agreement with such evaluations from diffusion experiments. Several features of the oxidation kinetics of zirconium and titanium were correlated as further elucidation of the properties of metals in Periodic Subgroup IVB. (auth)

8032 STUDY OF THE EQUILIBRIUM OF URANIUM OXIDES BETWEEN 1200 and 1800°. Anne Marie Anthony, Raisaku Kiyoura, and Toshiyuk Sata (CNRS, Paris and Tokyo Inst. of Tech.). Compt. Rend., 255: 1606-8(Oct. 1, 1962). (In French)

The equilibrium $UO_{2.60} \rightleftharpoons UO_{2.25} + 7/40\ O_2$ was studied between 1200 and 1800°C by sample tempering, thermobalance measurements, and x-ray diffraction. The U_3O_8 samples were held at a given temperature in an atmosphere with known nitrogen and oxygen concentrations; they were then abruptly tempered in water, dried, and ground. The powder is then heated in a hydrogen atmosphere and the weight loss is determined. Isobaric curves obtained show that at high temperature it is solid $UO_{2.25}$ (or U_4O_9) which is stable and that for a given partial oxygen pressure the equilibrium temperature $UO_{2.25}-UO_{2.60}$ is fixed. The results indicate a linear relationship between the inverse of the absolute temperature of the $UO_{2.60}$ decomposition into $UO_{2.25}$ and the log Po (partial oxygen pressure). The oxygen partial pressures were calculated for various temperatures. (J.S.R.)

8033 REDUCTION OF TRIVALENT EUROPIUM BY CADMIUM AMALGAM IN CHLORIDE MEDIUM. Mylène Bréant and Jean-Claude Merlin (Laboratoire de Chimie Minérale, Faculté des Sciences, Lyon). Compt. Rend., 255: 1609-11(Oct. 1, 1962). (In French)

The examination of intensity-potential curves relative to the oxidation of Cd(Hg) in Cd^{2+} and to the reduction of Eu^{3+} into Eu^{2+} shows that the reaction between the two systems is not possible in a noncomplexing medium, but that it proceeds in $|Cl^-|$ 10N solutions. It was verified that the reaction effectively takes place, that it is total, and that the velocity is limited only by the diffusion of Eu^{3+} ions. This method of reduction does not produce gaseous release. (tr-auth)

8034 THE NEUTRAL URANYL TELLURITE $(UO_2)(TeO_3)$. Parviz Khodadad (Laboratoire de Chimie Minérale, Faculté de Pharmacie, Paris). Compt. Rend., 255: 1617-18(Oct. 1, 1962). (In French)

The preparation of the neutral uranyl tellurite $(UO_2)(TeO_3)$ is described in detail. It results from the reaction of uranyl ions with freshly precipitated telluric acid. The uranyl tellurite obtained is a yellow microcrystalline powder. The measured density is 7.57. The principal chemical properties were determined. (J.S.R.)

8035 SOME HYDROLYSIS PRODUCTS OF DILUTED SOLUTIONS OF URANYL SALTS. Michèle Gauthier and Raymond Wey (Laboratoire de Physicochimie des Sols, Faculté des Sciences, Strasbourg). Compt. Rend., 255: 1626-8(Oct. 1, 1962). (In French)

The hydrolysis products of diluted solutions of uranyl salts, obtained in the vicinity of pH 5 whatever the ionic form of the uranium, evolve on contact with mother solutions. According to the quantity of CO_2 present in the system, either schoepite, $UO_3 \cdot 2H_2O$, or rutherfordine, UO_2CO_3, is obtained. (tr-auth)

8036 THE CONCENTRATION OF OXYGEN IN NITROGEN CRYOSTATS FOR REACTOR IRRADIATIONS. L. Heyne (Zentralinstitut für Kernphysik Rossendorf, Dresden). Cryogenics, 2: 332-3(Dec. 1962).

There is a connection between the concentration of oxygen and the danger of explosions in nitrogen cryostats for reactor irradiations. In cryostats, which operate with commercial liquid N, the portion of O in the liquid increases during operation due to the different velocities of evaporation of the two components (N and O). There is a saturation value for the O concentration which depends on the principle and construction of the cryostat. Values extend from 12% (Harwell cryostat) to 1% (flow-off cryostat) and to 0.1% (thermosiphon cryostat). The production of O due to nuclear reaction during the reactor irradiation is negligible. (auth)

8037 A STUDY OF DOUBLE OXIDES CONTAINING TUNGSTEN, TANTALUM OR NIOBIUM. L. M. Kovba and V. K. Trunov (Moscow Univ.). Dokl. Akad. Nauk SSSR, 147: 622-4(Nov. 21, 1962). (In Russian)

The reaction of UO_2, ThO_2, or CeO_2 with Ta_2O_5 or Nb_2O_5, and the reaction of Ta_2O_5 with WO_3, on sintering a mixture of oxides in air, nitrogen, or evacuated quartz tubes, were followed by x-ray analysis. The following reaction products were observed: $U(TaO_3)_4$, $U(NbO_3)_4$, $UO_2 + U(TaO_3)_4$, $Ce(NbO_3)_4$, $Th(TaO_3)_4$, $Th(NbO_3)_4$, $(U,W)\ O_3 + WO_2$, $U_{0.128}WO_3$, $U_{0.083}WO_3$, $3WO_3 \cdot Ta_2O_5$, $4WO_3 \cdot Ta_2O_5$, and $3WO_3 \cdot Nb_2O_5$. The $Me(M'eO_3)_4$ compounds are close to perovskite in structure, but a large number of superstructural lines are observed, and the true cell is tetragonal. The interatomic distances, observed by x-ray analysis, are listed for $Th(NbO_3)_4$ and $Th(TaO_3)_4$. Lattice parameters are given for $U(TaO_3)_4$, $Th(TaO_3)_4$, $U(NbO_3)_4$, $Th(NbO_3)_4$, and $Ce(NbO_3)_4$. Spacings intensities, and lattice parameters are given for the compounds $3WO_3 \cdot Ta_2O_5$ and $3Ta_2O_5 \cdot 4WO_3$. (TTT)

8038 REACTIONS BETWEEN Ce_2O_3 AND Al_2O_3 AT HIGH TEMPERATURES AND THE PROPERTIES OF OBTAINED CERIUM ALUMINATES. A. I. Leonov and E. K. Keler (Inst. of Chemistry of Silicates, Academy of Sciences, USSR). Izv. Akad. Nauk SSSR, Otd. Khim. Nauk, No. 11, 1905-10(Nov. 1962). (In Russian)

Reactions in $Ce_2O_3-Al_2O_3$ were analyzed and it is shown that two chemical compounds, $CeAlO_3$ with perovskite structure and $Ce_2O_3 \cdot 11Al_2O_3$ with β-alumina structure, form. The $CeAlO_3$ is stable in reducing atmosphere (hydrogen) and undergoes polymorphous transformations at 90 ± 20° and 980 ± 20°C. The melting point of $CeAlO_3$ is 2075 ± 25°C, and 1950 ± 25°C for $Ce_2O_3 \cdot 11Al_2O_3$. Cerium aluminates heated in air separate into free Ce_2O_3 and Al_2O_3. Dielectric penetrability and dielectric losses in $CeAlO_3$ and $Ce_2O_3 \cdot 11Al_2O_3$ were determined. (R.V.J.)

8039 STUDY OF INTERACTION OF CERIUM SULFATE(III) WITH ORTHOPHOSPHORIC ACID AND ITS SODIUM SALTS IN AQUEOUS SOLUTION AT 25°C. A. I. Ulianov, T. I. Kazakova, and E. Ya. Rumyantseva (Kurmakov Inst. of General and Inorganic Chemistry, Academy of

Sciences, USSR). Izv. Akad. Nauk SSSR, Otd. Khim. Nauk, No. 11, 1910-20(Nov. 1962). (In Russian)

Reactions of aqueous cerium sulfate with phosphoric acid and mono- and disodium salts result in precipitations of difficultly soluble cerium sulfate phosphates and neutral cerium phosphates. In $Ce_2(SO_4)_3-Na_3PO_4-H_2O$ the reaction results in the initial precipitation of the basic cerium sulfate phosphates followed by basic cerium phosphates and finally by neutral cerium phosphates. The density of the basic and neutral cerium phosphates diminishes at increased pH and depends on the ratio $PO_4^{3-}:Ce^{3+}$ in the initial components. The basic and neutral (at pH > 6) cerium phosphates oxidize at room temperature. (R.V.J.)

8040 FLUORIDE COMPLEXES OF PENTAVALENT URANIUM. R. A. Penneman, L. B. Asprey, and George Sturgeon (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc., 84: 4608-9(Dec. 5, 1962). (LADC-5479)

A new and direct synthesis for fluoride complexes of U(V) in high purity is reported. The technique involves direct combination of UF_5 with ammonium fluoride at 80-85°C or with alkali fluorides in a sealed bomb at 350-400°C. The identity of the compounds with those crystallized from aqueous HF established that the latter compounds contain U(V) in the nonoxygenated state. (P.C.H.)

8041 POLAR PROPERTIES OF BeO SINGLE CRYSTALS. S. B. Austerman (Atomics International, Canoga Park, Calif.), D. A. Berlincourt, and H. H. A. Krueger. J. Appl. Phys., 34: 339-41(Feb. 1963).

Piezoelectric, dielectric, and pyroelectric measurements were made on hexagonal BeO crystals grown in molten lithium molybdate flux. The piezoelectric constant $d_{33} \sim 0.24 \times 10^{-12}$ C/N, $\epsilon_{33}^T/\epsilon_0 \sim 7.6$, and the average free pyroelectric constant in the range −196 to 25°C is -3.4×10^{-10} C/cm² °C. The sound velocity perpendicular to the polar axis is 12,000 m/sec. Although no absolute identification of crystal planes was made, it was concluded from the sign of the piezoelectric constant d_{33} that the oxygen side of the closely coupled Be−O layer is that of principal growth and etch. Polarity of the crystal structure is reflected in typical crystal growth habits and in characteristic etch patterns which are described. (auth)

8042 INFRARED SPECTROSCOPIC EVIDENCE FOR THE ROTATION OF THE WATER MOLECULE IN SOLID ARGON. Richard L. Redington and Dolphus E. Milligan (Mellon Inst., Pittsburgh). J. Chem. Phys., 37: 2162-6 (Nov. 15, 1962).

High-resolution spectra of H_2O, HDO, and D_2O suspended in solid Ar were observed in the range 4-27°K. Evidence was obtained for the rotation of the species in Ar matrices. The majority of the observed lines was found to be in very good agreement with low-J transitions of the gas spectra, allowing for a small matrix shift. Transitions arising from both spin modifications of H_2O and D_2O were observed and the observed intensities suggest that a large degree of spin equilibration took place. A small contamination of O_2 may be responsible for this. A perturbation of one of the rotational levels of ν_2-H_2O is discussed. (auth)

8043 STUDIES OF METASTABLE ION TRANSITIONS WITH A 180° MASS SPECTROMETER. Norman D. Coggeshall (Gulf Research and Development Co., Pittsburgh). J. Chem. Phys., 37: 2167-75(Nov. 15, 1962).

The decay of metastable ions through transitions giving an ionized fragment and a neutral radical was investigated with a 180° mass spectrometer. Four aspects of the main problem were studied. These are: the decay of metastable ions within the ion source to produce a continuous distribution of metastable ions; an examination of the mathematical conditions relating dissociation beyond the ion-source exit slit to the formation of a metastable peak, to the shape of such a peak, to the cutoff imposed by the analyzer walls and to the length of travel during which detectable dissociation may occur; an examination of the conditions for determining lifetimes with a 180° instrument; and a consideration of the elements leading to the broadness of metastable peaks. The distribution function resulting from dissociation within the slit dropped very rapidly and was ordinarily hidden within the peak due to the daughter ion. The formation of a metastable peak in a 180° instrument resulted from a low-order dependence of where the ion fragment resulting from dissociation hits the focal plane of the position of dissociation beyond the exit slit. The cutoff mass due to ions striking the walls of the analyzer tube was readily calculated. In a CEC model 21-103 instrument there was adequate distance of free travel beyond the exit slit to allow the instrument to be used for lifetime measurements. Using repeller voltages up to 120 v, shorter lifetimes than those previously reported were observed. For the $m^* = 31.9$ metastable peak from n-butane, for example, there was evidence that the metastable ions are created in at least three classes, each with its own lifetime. The shortest lifetime observed was of the order of 9×10^{-9} sec. Evidence was obtained to indicate that the broadness of the observed metastable peaks is probably the result of the perturbation of focusing conditions by the increased angular spread in the ion beam. (auth)

8044 DISSOCIATION OF GASEOUS DIATOMIC MOLECULES. II. EFFECT OF ANHARMONICITIES. John C. Light (Univ. of Chicago) and Rodolphe Arnstein. J. Chem. Phys., 37: 2240-6(Nov. 15, 1962).

The classical adiabatic calculation of the rate of dissociation of diatomic molecules was extended to Morse potential oscillators in one-dimensional colinear collisions. The limits of error of the method were formulated and numerical calculations of the rates of dissociation of H_2 in Xe and I_2 in Ar were made assuming both the Morse and harmonic potentials. The harmonic results were in good agreement with experiment. Estimates of the errors involved show that the anharmonic results are not as reliable as the harmonic results. The distribution functions for a strongly interacting harmonic oscillator were also calculated. (auth)

8045 ABSORPTION SPECTRUM OF Nd^{3+} IN $LaBr_3$. Isaac Richman and Eugene Y. Wong (Univ. of California, Los Angeles). J. Chem. Phys., 37: 2270-2(Nov. 15, 1962).

The absorption spectrum of 0.5 mole % Nd^{3+} in a $LaBr_3$ single crystal was obtained and most of the crystalline field Stark levels identified. The spectrum is very similar to that obtained from Nd^{3+} in $LaCl_3$ and, in fact, the crystalline field parameters that fit $LaCl_3$ to 5 cm^{-1} fit $LaBr_3$ to 7 cm^{-1}. The major difference in the two spectra is a general shift of levels to the red in the $LaBr_3$. This is similar to the spectra of Pr^{3+} in $LaBr^3$ and $LaCl^3$. The explanation for this shift in both Pr^{3+} and Nd^{3+} spectra is probably the same. (auth)

8046 ABSORPTION SPECTRA OF GASEOUS HALIDE IONS AND HALOGEN ELECTRON AFFINITIES: CHLORINE, BROMINE, AND IODINE. R. Stephen Berry, Curt W. Reimann, and G. Neil Spokes (Yale Univ., New Haven). J. Chem. Phys., 37: 2278-90(Nov. 15, 1962).

Absorption spectra were taken of partially dissociated vapors of chloride, bromide, and iodide salts of rubidium and cesium. The salts were heated by shock waves. Continuous absorption spectra characterized by sharp thresholds are attributed to the ions Cl^-, Br^-, and I^-. The low-energy thresholds for the three ions fall at approximately

3424, 3685, and 4040 Å, respectively. From the threshold wavelengths and appropriate small environmental corrections, the electron affinities of chlorine, bromine, and iodine are determined to be 3.628 ± 0.005, 3.378 ± 0.005, and 3.078 ± 0.005 ev, respectively. (auth)

8047 PROTON MAGNETIC RESONANCE STUDIES OF POLYCRYSTALLINE URANIUM OXIDE HYDRATES. III. $UO_4 2H_2O$. A. L. Porte (Univ. of Glasgow), H. S. Gutowsky, and J. E. Boggs. J. Chem. Phys., 37: 2318-22 (Nov. 15, 1962).

The broad-line proton magnetic resonance spectrum of polycrystalline samples of the compound formulated empirically as $UO_4 2H_2O$ was investigated in the temperature range 77 to 356°K. Analyses of the absorption line shapes, and their derivatives, at 77 and 257°K, coupled with chemical analysis for peroxide oxygen, showed that the compound is essentially the dihydrate of uranyl peroxide, $UO_2(O_2) \cdot 2H_2O$. The sample investigated has about $1/12$ of its protons in UOH or UOOH groups of a second component, possibly a hydroperoxide, $UO(OH)_3(OOH)$, or hydroxy peroxide, $UO(OH)_2(O_2) \cdot H_2O$. At temperatures between 125 and 210°K, the absorption of the OH protons in this component undergoes changes which are compatible with self-diffusion. The apparent activation energy for the motion is 2 kcal. The two component formulation of the compound accounts for most, if not all, of its complex chemical behavior. (auth)

8048 MECHANICAL BASIS OF DIFFUSION. C. Truesdell (Johns Hopkins Univ., Baltimore). J. Chem. Phys., 37: 2336-44(Nov. 15, 1962).

Four types of theory of diffusion are distinguished, presented, and compared: kinematical, hydrodynamical, kinetic, and thermodynamic. A simple mechanical theory, based upon recognizing the diffusive drags as forces that produce motions, is shown to include and unify all earlier attempts. In this theory a hypothesis of binary drags is formalized and shown to lead to the symmetry relations proposed originally by Stefan. The Onsager relations for pure diffusion are proved to be equivalent to Stefan's relations. Known results show that the relations hold as a first approximation in the kinetic theory of monatomic gas mixtures. Whether or not they hold in higher approximation is unknown. (auth)

8049 ABSORPTION AND FLUORESCENCE SPECTRA OF HEXAGONAL $SmCl_3$ AND THEIR ZEEMAN EFFECTS. M. S. Magno and G. H. Dieke (Johns Hopkins Univ., Baltimore). J. Chem. Phys., 37: 2354-63(Nov. 15, 1962).

The absorption and fluorescence spectra of $SmCl_3$ were studied at 4°K and the Zeeman effects of many lines obtained in a magnetic field of 35 100 G. The lower group of levels obtained chiefly from the fluorescence spectrum can be unambiguously identified as the multiplet components of the ^6H and ^6F levels. The situation for the higher levels is confused. The splitting into Stark components of many of the levels could be determined with their symmetry and magnetic properties. (auth)

8050 CALCULATION OF CRYSTAL-FIELD SPLITTINGS OF Sm^{3+} AND Dy^{3+} LEVELS IN $LaCl_3$ WITH INCLUSION OF J MIXING. J. D. Axe and G. H. Dieke (Johns Hopkins Univ., Baltimore). J. Chem. Phys., 37: 2364-71 (Nov. 15, 1962).

Calculations of the crystal-field splitting of the low lying sextet multiplets of the f^6 and f^9 configurations in a field of C_{3h} symmetry were performed and the results are compared to experimental data on Sm^{3+} and Dy^{3+} in $LaCl_3$. The effect of inclusion of terms coupling different free ion J manifolds was examined, and several interesting features which arise from the effect are discussed. For Sm^{3+} 39 observed crystal-field levels were reproduced with a standard deviation of ±3.2 cm^{-1} with the crystal-field parameters $B_2^0 = A_2^0\langle r^2\rangle = 80.85\ cm^{-1}$, $B_4^0 = -22.75\ cm^{-1}$, $B_6^0 = -44.39\ cm^{-1}$, and $B_6^6 = 425.7\ cm^{-1}$. For Dy^{3+} 39 observed levels were reproduced with a standard deviation of ±2.7 cm^{-1} with the parameters $B_2^0 = 91.30\ cm^{-1}$, $B_4^0 = -38.97\ cm^{-1}$, $B_6^0 = -23.17\ cm^{-1}$, and $B_6^6 = 257.8\ cm^{-1}$. The remaining small discrepancies between calculated and observed levels can probably be attributed to inadequate free-ion wave functions. (auth)

8051 VIBRATIONAL SPECTRUM OF DIGERMANE. Victor A. Crawford, Kee H. Rhee, and M. Kent Wilson (Tufts Univ., Medford, Mass.). J. Chem. Phys., 37: 2377-86(Nov. 15, 1962).

Raman spectra of the liquid and infrared spectra of the gaseous and solid phase were obtained for Ge_2H_6 and Ge_2D_6. With the exception of the torsional mode all fundamental frequencies were located and assigned to the proper normal modes. The coarse rotational structure of the perpendicular bands, ν_7 and ν_8, was resolved and the corresponding Coriolis coupling coefficients determined. Comparisons with the spectra of ethane and disilane were made. (auth)

8052 CARBON AND OXYGEN ISOTOPE EXCHANGE BETWEEN CO AND $Ni(CO)_4$. E. U. Monse and W. Spindel (Rutgers Univ., Newark, N. J.). J. Chem. Phys., 37: 2393-7(Nov. 15, 1962).

The single stage factor α of the carbon and oxygen isotope exchanges between liquid $Ni(CO)_4$ and gaseous CO, according to the reactions $Ni(C^{12}O)_4 + C^{13}O \rightleftharpoons Ni(C^{12}O)_3C^{13}O + C^{12}O$ and $Ni(CO^{16})_4 + CO^{18} \rightleftharpoons Ni(CO^{16})_3CO^{18} + CO^{18}$, respectively, was determined: For the carbon exchange, $\alpha = 1.020 \pm 0.002$ at $-10°$ and $\alpha = 1.010 \pm 0.002$ at $+10°$, and for the oxygen exchange, $\alpha = 1.005 \pm 0.002$ at $-10°$ and $\alpha = 1.000 \pm 0.002$ at $+10°$. The data are in good agreement with values calculated from spectroscopic data for $Ni(CO)_4$ and CO. From the isotope fractionation measured in a packed countercurrent column, the activation energy E for the exchange was estimated. The value of E = 12 kcal/mole agreed with the results obtained from kinetic data for the thermal decomposition of $Ni(CO)_4$ and the exchange of $Ni(CO)_4$ with labeled CO. The rate of the thermal decomposition of $Ni(CO)_4$ was assumed to be the rate determining step in the exchange. (auth)

8053 APPROXIMATE EXCITED EIGENFUNCTIONS FOR Pr^{3+} AND Tm^{3+}. Katheryn Rajnak (Univ. of California, Berkeley). J. Chem. Phys., 37: 2440-4(Nov. 15, 1962). (UCRL-10134)

Approximate 5d, 6s, 6p, and 5f radial wave functions, which are necessary for any investigation of the effect of configuration interaction in rare-earth spectra, were obtained for Pr^{3+} and Tm^{3+}. The calculations were based on the ground-state eigenfunctions obtained in an SCF calculation without exchange. $\langle r^2\rangle$, $\langle r^4\rangle$, $R^k(4f4f, 4f6p)$, and $R^k(4f4f, 4f5f)$ integrals were calculated. (auth)

8054 DETERMINATION OF ELECTRONIC ENERGY LEVELS OF MOLECULES BY LOW-ENERGY ELECTRON IMPACT SPECTROSCOPY. Aron Kuppermann and Lionel M. Raff (Univ. of Illinois, Urbana). J. Chem. Phys., 37: 2497-8(Nov. 15, 1962).

Description is given of a new spectroscopic tool in which optically forbidden electronic transitions can usually be detected as clearly as optically allowed ones in a fairly routine manner. The method uses the inelastic scattering of low-energy electrons by molecules as the means for determining electronic energy levels. The performance of the apparatus was determined using He, Ar, and H_2 as test gases. Within the inherent resolution (0.33 ev) and accuracy (±0.25 ev), agreement with the optical values was excellent. (P.C.H.)

8055 RUBIDIUM SPIN RELAXATION INDUCED BY HYDROGEN. Richard G. Brewer (Univ. of California, Los Angeles). J. Chem. Phys., 37: 2504-5(Nov. 15, 1962).

An experimental comparison was made of the spin relaxation cross sections for Rb in the presence of H_2 and D_2. It is shown that the disorientation cross sections for Rb are about the same in H_2 and D_2 and that the spin-orbit coupling still appears to be more important than the dipolar mechanism. (P.C.H.)

8056 VARYING ORBITAL EXPONENTS IN MOLECULAR ORBITAL THEORY. James T. Dehn (Georgetown Univ., Washington, D. C.). J. Chem. Phys., 37: 2549-53 (Dec. 1, 1962).

By means of the variational principle a set of conditions is derived for the orbital exponents which minimize the energy in the LCAO form of molecular orbital theory, using Slater atomic orbitals. The equations are to be solved simultaneously with Roothaan's conditions for the best LCAO coefficients. The method is illustrated for the molecular ion H_2^+ and the molecule He_2. (auth)

8057 LATTICE COMBINATION BANDS IN INFRARED SPECTRA OF MOLECULAR SOLIDS. R. G. Gordon (Harvard Univ., Cambridge, Mass.). J. Chem. Phys., 37: 1587-94(Dec. 1, 1962).

Combination bands between lattice modes and internal modes are discussed. It is shown that a certain amount of information about the intensity of such bands and their temperature dependence can be predicted without a solution to the complete dynamical problem of the lattice vibrations. (auth)

8058 THERMAL STUDY OF CRYSTAL FIELD SPLITTINGS IN ERBIUM ETHYLSULFATE. B. C. Gerstein, C. J. Penney, and F. H. Spedding (Ames Lab., Ames, Iowa). J. Chem. Phys., 37: 2610-15(Dec. 1, 1962). (IS-461)

The heat capacities of erbium and yttrium ethylsulfates were measured in the range 12-300°K. The magnetic contribution of the erbium ion was evaluated with the help of an assumption concerning the difference in lattice contributions between the erbium and yttrium salts. The contribution agrees, to within experimental error, with the experimental energy level scheme for the $^4I_{15/2}$ state previously published. (auth)

8059 EFFECT OF OXYGEN ON THE VAPOR PRESSURE OF URANIUM. R. J. Ackermann, E. G. Rauh, and R. J. Thorn (Argonne National Lab., Ill.). J. Chem. Phys., 37: 2693-8(Dec. 1, 1962). (TID-13525)

Observations pertaining to the vapor pressure of uranium were examined for consistencies. Using all the data, a diagram schematically describing the effect of oxygen on the vapor pressure of uranium was constructed. (auth)

8060 LARGE DEUTERIUM ISOTOPE EFFECT IN THE REACTION OF PROPANE WITH Hg $6(^3P_1)$ ATOMS. Yves Rousseau, George N. C. Woodall, and Harry E. Gunning (Univ. of Alberta, Edmonton, Can.). J. Chem. Phys., 37: 2722-3(Dec. 1, 1962).

The primary yield data in the reaction of Hg $6(^3P_1)$ atoms with propane and the quenching cross section yields (σQ^2) were combined to determine the deuterium isotope effect on the primary reaction. The magnitudes of the effects are reported for the propanes. It was found that the secondary bond effect was very large, 16-18 times in favor of C–H over C–D. For primary C–H bond cleavage the deuterium isotope effect was much smaller than for the secondary positions, yet still abnormally high for deuterium substitution. (P.C.H.)

8061 ON POSSIBLE LOW-PRESSURE POLYMORPHISM IN LiH. Raoul Weil and A. W. Lawson (Univ. of California, Riverside). J. Chem. Phys., 37: 2730-1(Dec. 1, 1962).

The compression of LiH was determined to about 6 kbar. The compression as a function of pressure is shown. The initial compressibility of LiH determined from the slope of the curve was 3.7×10^{-4} cm^2/kg. However, there was no evidence of any phase transition up to 6 kbar. (P.C.H.)

8062 VIBRATIONAL CONSTANTS FOR THE GROUND STATE OF H_2. Mohammad Shafi and Charles L. Beckel (Georgetown Univ., Washington, D. C.). J. Chem. Phys., 37: 2732-3(Dec. 1, 1962).

Drawbacks in representing the vibrational energies of diatomic molecules by power series in the vibrational quantum number ν are given. The expression $\Delta G = [A-B(\nu + \frac{1}{2})]/[1-C(\nu + a)^n]$ was found to fit the experimental ΔG values of H_2 more satisfactorily than the usual power series. The ΔG's are the first vibrational energy differences, and A, B, C, a, and n are adjustable parameters. Since slight changes in a and n do not produce significant changes in the results, a simplified least squares method was used to fit the expression to the experimental ΔG's. The advantage of the expression over the power series is that it gives a better fit within the range used and yields a more consistent set of spectroscopic constants as the range of fit is altered. (P.C.H.)

8063 CONVERSION OF $C_v[T,V(T)]$ to $C_v[T,V(0°K)]$ WITH APPLICATION TO Na AND Cu. William C. Overton, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys., 37: 2975-85(Dec. 15, 1962). (LADC-5403)

The thermodynamic quantity $E(T) = \int_{V_0}^{V}(\partial C_v/\partial V)_T dV = C_v[T,V(T)] - C_v[T,V(0°K)]$ may be evaluated in terms of the thermal expansion and the coefficients, a_i's, in the solid equation of state and their derivatives. Slater's procedure for E(T) is extended herein to the case in which the a_i's are arbitrary functions of temperature and pressure. This E(T) is then transformed to a second equivalent form in terms of the bulk modulus and its temperature and pressure derivatives. It is seen that $C_v[T,V(0)]$ may be determined entirely from experimental data. The lattice specific heat $C_L[T,V(0)] = C_v[T,V(0)] - T\gamma_0[V(0)]$, this form being the physically correct way of calculating C_L from electronic specific heat measured at low temperatures, is determined for Na and Cu. The $C_L[T,V(0)]$ of Na is compared with the Born-von Kármán theoretical $C_{theoret}$ calculated by C. B. Clark, this comparison indicating an anharmonic C_L of the form $C_{theoret}(1 + AT + BT^n)$, $(5 < n < 6)$, where A is only one-sixth that calculated by Leibfried and Ludwig for $C_p[T,V(T)]$. Comparison of $C_L[T,V(0)]$ of copper with theoretical specific heat calculated by the author shows quantitative agreement (within 0.2% from 50 to 300°K) thus indicating the adequacy of the central force model with nearest- and next-nearest-neighbor forces used. (auth)

8064 SEPARATION FACTORS IN FRACTIONAL CRYSTALLISATION OR PRECIPITATION OF THE LANTHANONS. R. J. Callow (Thoriam Ltd., Ilford, Essex, Eng.). J. Chem. Soc.: 4353-61(Nov. 1962).

Previous work on systems of two isomorphous salts and water is shown to lead to the postulate from which the logarithmic separation law, $\log[a/(a-x)] = \lambda \log[b/(b-y)]$, was derived for separation of radium and barium. For lanthanon separation the law was found to represent both fractional crystallization and fractional precipitation. The value of the coefficient λ for a particular system characterizes the efficiency of separation; by comparison of such values, a number of separation techniques were compared. When the value of the coefficient for a particular system is known, a calculation based on entropy consid-

erations can be made to determine the most efficient way of using the system in an actual separation. Examples of such calculations are given, one of which is shown experimentally to lead to a greatly increased efficiency of separation. (P.C.H.)

8065 URANIUM, PLUTONIUM, BERYLLIUM, AND ZIRCONIUM COMPLEXES OF 2-CARBOXYPYRIDINE N-OXIDE. A. Heller, R. Elson, and Y. Marcus (Israel Atomic Energy Commission Labs., Sorel Research Establishment, Rehovoth). J. Chem. Soc.: 4738-9(Nov. 1962).

Complexes of limited solubility were precipitated on addition of 1% solutions of 2-carboxypyridine N-oxide to solutions of U(VI), Pu(VI), Pu(IV), Zr(IV), and Be. Properties of the complexes are given. A possibility for application of the acid for the separation of U(VI) and Pu(VI) from other metals was indicated by the fact that only their complexes are insoluble in boiling aqueous solutions at pH 2 to 3. (P.C.H.)

8066 SYNERGISTIC EFFECTS IN THE EXTRACTION OF SELECTED METALLIC CATIONS BY MONO (2-ETHYL HEXYL) PHOSPHORIC ACID. G. W. Mason, S. McCarty, and D. F. Peppard (Argonne National Lab., Ill.). J. Inorg. & Nucl. Chem., 24: 967-77(Dec. 1962). (In English)

The effect of synergistic agents upon the extraction of M(III) lanthanides, Y(III), Am(III), Cm(III), Th(IV), and U(VI) by H_2MEHP, mono 2-ethyl hexyl phosphoric acid, in a carrier diluent from aqueous HCl was investigated as a function of carrier diluent, synergistic agent, concentration of H_2MEHP, and Z of M(III) lanthanides. It was found that a plot of log K vs log (r-0.5) or log (r-2), depending upon the synergist, is more meaningful than a plot of log K vs F or log F of the synergist, where r is the ratio, (F of synergist/F of H_2MEHP). For some elements as r increases from zero, K rises to a maximum (region of positive synergism); in others no positive synergism is noted. In each instance in which a maximum is found, the maximum becomes progressively more pronounced as the synergist is varied from n-decanol to TBP, tri-n-butyl phosphate, to TOPO, tri-n-octyl phosphine oxide. In the negative synergism range, the limiting slope of the log K vs log (r-0.5) plot for all of the M(III) examples studied (TBP synergist, cyclohexane and toluene diluents) is –3. Similarly, the limiting slope of the log K vs log (r-2) plot (n-decanol synergist, cyclohexane diluent) is –3 for M(III), –4 for Th(IV) and –2 for U(VI). The extractant dependency for Eu(III) and Am(III) by H_2MEHP in the absence of synergist is shown to be first power in toluene diluent and third power in n-decanol diluent. Z-studies in the diluents toluene, cyclohexane, and n-decanol are included. Tentative explanations of the negative synergistic effects are proposed in terms of assumed chemical interaction between synergist and H_2MEHP, and possible applications of these effects are suggested. (auth)

8067 AQUEOUS SYSTEMS AT HIGH TEMPERATURE. VII. LIQUID-LIQUID IMMISCIBILITY AND CRITICAL PHENOMENA IN THE SYSTEMS $UO_3-SO_3-H_2O$, $UO_3-SO_3-D_2O$ AND $CuO-SO_3-D_2O$, 270–430°C. William L. Marshall, Ernest V. Jones, G. M. Hebert, and F. J. Smith (Oak Ridge National Lab., Tenn.). J. Inorg. & Nucl. Chem., 24: 995-1000(Dec. 1962). (In English)

In the condensed systems $UO_3-SO_3-H_2O$, $UO_3-SO_3-D_2O$, and $CuO-SO_3-D_2O$ boundary limits of liquid–liquid immiscibility were extended to compositions at which L_1 = V = supercritical fluid at several fixed concentrations of SO_3. These (isothermal) critical end points were found at temperatures between 374 and 430°C with solutions having molal ratios, $m_{\text{metallic oxide}} : m_{SO_3}$, between 0.20 and 0.50 depending upon the concentration of SO_3 in the systems. A second liquid phase was not observed at lower molal ratios. Instead, critical phenomena (used to designate the disappearance of the meniscus between liquid and vapor phases and not to specify the appearance of a second liquid phase) revealed concentrations of UO_3 or of CuO as high as 0.25 molal in a supercritical fluid SO_3-D_2O, 1.0 molal in SO_3. These observations coincided with those made previously which showed an appreciable solubility of the NiO component in the supercritical fluid SO_3-H_2O. (auth)

8068 THE SOLUBILITY OF PLUTONIUM(VI) CARBONATE IN LITHIUM ACID CARBONATE. L. J. Wittenberg and R. H. Steinmeyer (Monsanto Chemical Co., Miamisburg, Ohio). J. Inorg. & Nucl. Chem., 24: 1015-1016(Dec. 1962). (In English)

The solubility of PuO_2CO_3 in $LiHCO_3$ solutions was measured for $LiHCO_3$ concentrations of 0 to 0.94 M at 24°C. When the Pu and $LiHCO_3$ concentrations of the saturated solutions were plotted against each other on a log-log graph, the slope of the resulting straight line was 1.0, indicating that the solubility reaction is $PuO_2CO_3(s) + LiHCO_3(aq) \rightarrow LiPuO_3(CO_3)(HCO_3)(aq)$, with an equilibrium constant of 0.13. Saturated solutions of PuO_2CO_3 in $LiHCO_3$, equilibrated with 1000 psi CO_2, were found to form light pink precipitates which quantitatively removed the Pu from the solutions. (D.L.C.)

8069 THE QUESTION OF THE REACTION MECHANISM OF THE ISOTOPE EXCHANGE REACTION $PtCl_6^{2-} + \overset{*}{Cl}^- \rightleftharpoons Pt\overset{*}{Cl}_6^{2-} + Cl^-$. R. Dreyer (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 5: 618-21(Aug. 1962). (In German)

The temperature and concentration dependence of the isotope exchange reaction $PtCl_6^{2-} + Cl^-$ was measured. The activation energy of the reaction was determined to be 12 kcal/mol. Additions of oxidation and reaction media lead to a reduction or increase of the reaction velocity. $PtCl_4^{2-}$ accelerates the exchange reaction. A reaction mechanism using the participation of Pt(II)-Pt(IV) bridge complexes was discussed. (tr-auth)

8070 ANALYSIS OF HIGH RESOLUTION ELECTRON SPIN RESONANCE SPECTRA. A REINTERPRETATION OF THE WURSTER'S BLUE ION SPECTRUM. J. R. Bolton, A. Carrington, and J. dos Santos-Veiga (Cambridge Univ., Eng.). Mol. Phys., 5: 615-19(Nov. 1962).

Previous interpretations of the electron spin resonance spectrum of Wurster's Blue cation are shown to be incorrect. In particular the nitrogen hyperfine splitting constant previously quoted as 0.28 gauss is, in fact, 7.0 gauss. A complete analysis of the spectrum is described. (auth)

8071 FLUORESCENT PROPERTIES OF RARE EARTH CHELATES IN VINYLIC HOSTS. N. Filipescu, M. R. Kagan, N. McAvoy, and F. A. Serafin (Melpar, Inc., Falls Church, Va.). Nature, 196: 467-8(Nov. 3, 1962).

'Observations are reported on sharp-line fluorescence of orbital transitions resulting from rare earth chelates dissolved in organic vinylic monomers that were polymerized to solid solutions. It is pointed out that these materials are more easily and accurately doped than either glasses or single crystals and the simplicity of preparation and workability of these materials make them particularly attractive for possible laser application. Methods used in the preparation of the material are described briefly. Broad band luminescence centered at 5200 Å from all the β-diketone chelates in polymethylmethacrylate was excited at an absorption band centered at 4100 Å. This luminescence was attributed to the resonating chelated rings. (C.H.)

8072 THE DEUTERIZATION OF ION EXCHANGE COLUMNS. P. Baertschi (EIR, Würenlingen, [Switzerland).] Neue Tech., 4: 469-75(Sept. 1962). (In German)

By displacement of H_2O by D_2O and vice versa in an ion exchange column the volume of the mixed H_2O/D_2O zone was determined as a function of the flow rate. For two types of mixed bed ion exchange resins the minimum volumes of the mixed zone and the corresponding flow rates were calculated, and the results tabulated. In a crude but useful manner the optimum flow rate can be related to the diameter a (mm) of the largest resin particles by $\nu_{opt} \simeq (3.5/a)$ ml/dm^2 min. The deuterization leads to mixed zones which are larger by some 10% than in the case of dedeuterization. The diffusion constant of H_2O in the wet resin was determined to be $D_H = 1.1 \times 10^{-5}$ cm^2 sec^{-1} and that of H_2O in the heterogeneous water-resin column to be $D_S = 1.3 \times 10^{-6}$ cm^2 sec^{-1}. The influence of temperature and column dimensions is discussed as well as some other aspects of the practical deuterization of ion exchange resins and other materials. (auth)

8073 NUCLEAR MAGNETIC RESONANCE AND PREFERRED ORIENTATION IN HOT-PRESSED POLYCRYSTALLINE BeO. G. J. Troup (Monash Univ., Clayton, Victoria, Australia). Phys. Letters, 2: 9-11(Aug. 1, 1962). (In English)

Cylindrical samples of polycrystalline BeO were prepared by hot-pressing at 1700°C and cooling to room temperature at a controlled rate. Sufficient preferred orientation was observed in the samples to allow the quadrupolar splitting to be measured. Nuclear magnetic resonance mode spectra are shown for the samples under various experimental conditions. (H.D.R.)

8074 SPIN-WAVE DISPERSION CURVES FOR MAGNETITE. E. J. Milford and M. L. Glasser (Battelle Memorial Inst., Columbus, Ohio). Phys. Letters, 2: 248-9(Oct. 1, 1962). (In English)

Watanabe and Brockhouse have previously reported inelastic neutron scattering experiments that make possible the reconstruction of the acoustic spin-wave dispersion curve out to the edge of the Brillouin zone and the long wavelength portion of one of the optical modes. In this work the long wavelength approximation is avoided, and the dispersion laws are obtained for all six modes in forms that are valid for all momenta in the first Brillouin zone and are appropriate for an inverse spinel. Calculated dispersion curves are shown for an inverse spinel with spins and phase factors for neighboring spins corresponding to ordered magnetite. These curves are found to be in excellent agreement with experiment, and the spin-wave approximation appears to be a good one for values of ka (k = spin-wave wave-vector, a = lattice parameter) as large as unity. (H.D.R.)

8075 A SPIN-ROTATION NUCLEAR RESONANCE RELAXATION EFFECT FOR A LARGE MOLECULE. J. G. Powles and D. K. Green (London Univ.). Phys. Letters, 3: 134-5(Dec. 15, 1962). (In English)

Measurements are presented on the spin-lattice relaxation time for protons, $T_1(H^1)$, and for F^{19}, $T_1(F^{19})$, in liquid fluorobenzene (C_6H_5F) under its own vapor pressure, at −66 to 200°C and resonance frequencies of 56.4 and 21.5 Mc. An observed fall in $T_1(F^{19})$ at higher temperatures is believed to be due to spin-rotation interaction, and the spin-rotation contribution to the relaxation for larger molecules is examined. It is concluded that the observed effect may be more wide-spread than is usually supposed, indicating that molecules in liquids are able to rotate rather more freely than has been suspected. An intramolecular dipole-dipole interaction contribution to $T_1(H^1)$ in liquids is indicated. (H.D.R.)

8076 ON THE INTERPRETATION OF THE NITROGEN-14 HYPERFINE INTERACTIONS IN ELECTRON SPIN RESONANCE SPECTRA OF HETEROCYCLIC ANIONS. J. C. M. Henning and C. de Waard (Universiteit, Amsterdam). Phys. Letters, 3: 139-41(Dec. 15, 1962). (In English)

An attempt is made to show that neighbor-spin-densities give a significant positive contribution to the N^{14} hyperfine interactions. The ESR spectra were measured for the heterocyclic anions pyrazine, 1-4-diazonaphthalene, 1-5-diazonaphthalene, and $\gamma\gamma$-dipyridyl. From the measured proton hyperfine splittings the spin-densities (ρ) at the CH-positions were determined by means of the linear relation $A = Q^H\rho$, with $|Q^H| = 22.5$ gauss, where A is the proton hyperfine coupling constant. The experimental A^N and ρ_N data are summarized and discussed. The calculations were repeated for different values of Q^H, and the values of the coupling factors were found to be only slightly dependent on Q^H. Interpretation of the nitrogen lines observed in the four spectra presented leads to the conclusion that A^N is positive in these ions. (H.D.R.)

8077 THE ELECTRONIC STRUCTURE OF CHROMIUM GROUP METALS FROM LOW FIELD DE HAAS-VAN ALPHEN STUDIES. G. B. Brandt and J. A. Rayne (Westinghouse Electric Corp., Pittsburgh). Phys. Letters, 3: 148-9(Dec. 15, 1962). (In English)

Results are presented of low field De Haas-Van Alphen measurements that give fairly convincing identification of small pockets of electrons or holes in the Fermi surfaces of chromium, molybdenum, and tungsten. Oscillations have been observed on all three metals at fields up to 17 kilogauss. In all cases one dominant period with $\Delta(1/H) \sim 2 \times 10^{-7}$ gauss^{-1} has been observed for all orientations. The experimental and theoretical extremal areas for H || [001] are compared, and the variation of $\Delta(1/H)$ for low field period in Mo with [110] axis vertical is shown. The presence of these extremal areas in all three metals gives considerable support for the proposed model of the Fermi surface. (H.D.R.)

8078 SPIN-WAVE CONTRIBUTION TO THE SPECIFIC HEAT OF EuS. D. C. McCollum, Jr. and J. Callaway (Univ. of California, Riverside). Phys. Rev. Letters, 9: 376-7 (Nov. 1, 1962).

An indirect exchange coupling mechanism has been proposed as a possible explanation of the nature of the ferromagnetic exchange coupling of EuS. Specific heat measurements on EuS were made and the results were compared with the predictions of spin-wave theory. The agreement between theory and experiment is very good in the determination of the $T^{3/2}$ term in the spin-wave specific heat and in the relation between the exchange integral and the Curie temperature. It is concluded that the spin system in EuS can be described at least phenomenologically by a simple Heisenberg spin Hamiltonian. (H.D.R.)

8079 ION FORMATION AT HOT METAL SURFACES. Manfred Kaminsky (Argonne National Lab., Ill.). Physik. Verhandl., No. 1-2, 60-97(1962). (TID-13248). (In German)

The formation and emission of both positive and negative ions at metal surfaces are described. Theoretical considerations are presented. The relationship of the Saha-Langmuir and Frenkel equations is discussed. Experimental methods are described and results are given in tables and graphs. (M.C.G.)

8080 CRYSTALLOCHEMICAL PROPERTIES OF THE SULFIDES OF RARE-EARTH METALS AND ACTINIDES. G. V. Samsonov (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 4, 11-19(July-Aug. 1962). (In Russian)

The crystallochemical and physical properties of sulfides and oxysulfides of rare-earth metals are considered, and the principal regularities of their correlation with the peculiarities of the electron structure of rare-earth metal atoms are shown. An assumption is advanced as to the nature of the chemical connection between atoms of the rare-earth metals and sulfur, as well as among the sulfur atoms in sulfides, and the changes occurring on passing from metal rich phases to sulfur rich phases. (auth)

8081 INVESTIGATION OF BORIDES OF TRANSITION METALS AND PURE BORON BY THE METHOD OF NUCLEAR MAGNETIC RESONANCE. O. T. Malyuchkov and V. A. Povitskii (Moscow Steel Inst.). Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 4, 26-34(July-Aug. 1962). (In Russian)

The method of nuclear magnetic resonance was used to investigate diborides of TiC, Zr, Nb, Ta, Cr, and Mo_2B_5 in which quadrupole effects of the first and second orders were discovered. The constants of quadrupole binding were found. The same constants were computed under the assumption that boron atoms possess hybridized spd^4 orbits that affect the boron—metal binding and Sp^3 orbits for boron—boron binding. The calculated values are in satisfactory agreement with experiment. This valency scheme and the known physical properties were used for establishing the mechanism of filling d shells of metal atoms with boron electrons. A constant quadrupole bond was found in chromium monoboride. Assumptions are advanced as to the bonds in this compound. Knight's anisotropic shift and quadrupole effects were noted in lanthanum hexaboride. The hybrid orbits apparently correspond to the p^3s^2 configuration with a weight of about 9%. Changes in the shape of the lines were noted for various samples of pure boron. This is evidently connected with the change in structure of the tricentric bonds depending on the arrangement of icosahedrons of boron atoms in the lattices of its polymorphous modifications. (auth)

8082 CORRECTED L_{β_1} EMISSION BAND OF NIOBIUM AND THE BINDING FORCES IN THE NIOBIUM–NITROGEN SYSTEM. M. I. Korsunskii, Y. E. Genkin, and T. S. Verkhoglyadova (Kharkov Lenin Polytechnic Inst. and Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 4, 35-8(July-Aug. 1962). (In Russian)

Corrected L_{β_1} emission bands of niobium in the niobium–nitrogen system made it possible to ascertain the nature of the interatomic binding precisely together with electric and magnetic measurements. The L_{β_1} emission bands of niobium in compounds of niobium with nitrogen consist of two parts, corresponding to collectivized and bound electrons. It is shown that in compounds of niobium with nitrogen in concentrations of 6.32, 6.8, 8.1, 11.9, and 13% by weight of nitrogen the concentration of the collectivized electrons is considerably less than in niobium. In these compounds electrons occupy less than half of the Brillouin zone, which results in the primarily electronic nature of conductance in the compounds. The share of the covalent and metallic binding in niobium nitrides is lowered in comparison with pure solid niobium. (auth)

8083 CHEMICAL STABILITY AND STRUCTURE OF BORIDES. L. Ya. Markovskii (Leningrad State Inst. of Applied Chemistry). Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 4, 39-45(July-Aug. 1962). (In Russian)

The hydrolytic stability of borides of alkali earth and transient metals with varying contents of boron was studied. It is shown that during the processes of hydrolytic decomposition of borides the principal role is played by the strength of the boron—boron bonds. The regularity of the enhancement of the chemical stability of borides with a rise in the boron content and complication of complexes of boron atoms was confirmed. (auth)

8084 HYPERCONJUGATION AND PROTON HYPERFINE INTERACTION: ANGULAR DEPENDENCE. Shigeyuki Aono (Chiba Univ., [Japan]) and Jiro Higuchi. Progr. Theoret. Phys. (Kyoto), 28: 589-98(Oct. 1962). (In English)

Proton hyperfine splittings arising from the hyperconjugation mechanism are investigated for methyl-substituted conjugated radicals and ions. In this case, these molecular species are treated by dividing them into two groups, i.e., the methyl substituent and the conjugated system. The total wave functions are obtained by using first-order perturbation theory. The result indicates that the coupling constant from the hyperconjugation mechanism is proportional to the unpaired π-electron density of atom bonded to the methyl substituent and also depends on the orbital energy of the unpaired π-electron. Angular dependence of the coupling constant arising from the relative orientation of the methyl substituent to the conjugated system has also been discussed. Some applications to several semiquinone ions, toluene ions, ethyl radical, and a radical in irradiated polyethylene are made. (auth)

8085 THERMOGRAVIMETRY OF SOME URANIUM^{VI} 8-HYDROXYQUINOLATES. Jon Bordner and Louis Gordon (Case Inst. of Tech., Cleveland). Talanta, 9: 1003-7(Dec. 1962). (In English)

The thermogravimetric behavior of $UO_2(C_9H_6NO)_2 \cdot C_9H_6NOH$ and $[UO_2(C_9H_6NO)_2]_2 \cdot C_9H_6NOH$, prepared by precipitation from homogeneous solution with 8-acetoxyquinoline, was found to closely resemble that of $UO_2(C_9H_6NO)_2 \cdot C_9H_6NOH$, prepared by direct precipitation of uranium(VI) with 8-hydroxyquinoline. (auth)

8086 VAPOR PRESSURE MEASUREMENTS ON HALIDES OF THE RARE EARTHS. Eiichi Shimazaki and Kichizo Niwa (Univ. of Hokkaido, [Japan]). Z. Anorg. Allgem. Chem., 314: 21-34(Feb. 1962). (In German)

The sublimation pressure of the halides of lanthanum, cerium, praseodymium, and neodymium (with exception of fluorides and cerium iodide) was determined by means of Knudsen's effusion method. From the results, heats of sublimation and other thermodynamic values of the salts were calculated. The heat of sublimation decreased with decreasing cation radius or with increasing anion radius, i.e., from lanthanum chloride to neodymium chloride or from lanthanum chloride to lanthanum iodide. This effect is explained as the result of the deformation of ions. (auth)

8087 CRYSTAL FIELD CLEAVAGE OF THE ETHYL SULFATES OF SOME RARE EARTHS. S. Huefner (Technische Hochschule, Darmstadt, Ger.). Z. Physik, 169: 417-26(1962). (In German)

The crystal field parameters $A_2^0\langle r^2\rangle$, $A_4^0\langle r^4\rangle$, $A_6^0\langle r^6\rangle$, and $A_6^4\langle r^6\rangle$ of hexagonal ethyl sulfates of praseodymium, neodymium, samarium, terbium, dysprosium, and holmium were determined from spectroscopic data. A systematic path of the crystal field parameters for the rare earth series is given that can describe the systematic variation of the coupling between 4f electrons and crystal lattices. (tr-auth)

8088 UV SPECTRUM OF TRIVALENT HOLMIUM IN CRYSTALLINE SALTS. S. Huefner (Technische Hochschule, Darmstadt, Ger.). Z. Physik, 169: 427-31(1962). (In German)

The ultraviolet absorption spectrum of Ho^{3+} in hexagonal ethyl sulfate and monoclinic hydrous chloride was investigated at low temperatures. The correlation of experimental terms with theoretical terms is successful in the range 24,000 and 30,000 cm^{-1}. (tr-auth)

8089 ELECTRON PARAMAGNETIC RESONANCE OF Zr^{3+} IN GLASSES. N. S. Garif'yanov and N. R. Yafaev (Physico-Technical Inst., Kazan Branch of Academy of Sciences, USSR). Zh. Eksperim. i Teoret. Fiz., 43: 1978-9(Nov. 1962). (In Russian)

Silicate glasses with a molar composition of $20Na_2O \cdot 70SiO_2 \cdot 10ZrO_2$ containing Zr^{3+} were investigated by means of the electron paramagnetic resonance (EPR) method, in order to obtain data on the unstable trivalent Zr compounds. The measurements were carried out at frequencies of 450 and 9320 Megaherz and at 77 and 295°K. At 77° and 450 Megaherz a narrow and symmetrical EPR line was observed, while at 9320 Megaherz at the same temperature a wide and symmetrical line was noted; no lines were observed at room temperature at either of the 2 frequencies. The shape and width of the Zr^{3+} lines at the higher frequency are determined by the anisotropy of the g factor and by the degree of distortion of the oxygen octahedra. Hyperfine structure splitting of the EPR lines from the uneven Zr^{91} isotope (11.23%) was unsuccessful; this may be due to the fact that at the higher frequency the width of the line is apparently comparable with the hyperfine splitting constant while at the lower frequency the required condition of a strong field is not fulfilled. (TTT)

8090 INCIPIENT SOLIDIFICATION CURVES OF HELIUM ISOTOPE SOLUTIONS. N. G. Bereznyak, I. V. Bogoyavlenskii, and B. N. Esel'son (Physico-Technical Inst., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teoret. Fiz., 43: 1981-2(Nov. 1962). (In Russian)

The phase equilibrium of the liquid and solid phases of He^3 solutions in He^4 were investigated. For obtaining the data needed for determining the phase diagram of the system, thermal analysis experiments were carried out, determining the correlation between the solidification pressure and the composition of the liquid phase. A carbon resistance thermometer was used for the temperature measurements while the pressure was calculated from the elastic deformation of the walls of the calorimeter. Solutions containing 10.3, 24.1, 53.0, and 76.4% He^3 were studied, together with pure He^4 used for calibrating the instruments at temperatures ranging from 1.5 to 4.2°K and pressures up to 140 atm. The average error did not exceed 0.01° and 0.5 atm. Results showed that increasing the concentration of the lighter isotope in the solution caused an increase of the incipient solidification pressure throughout the examined temperature range. The data obtained made it possible to plot the liquidus curve of the system. The equilibrium diagram of the solid and liquid phases probably possesses a narrow stratification region. The data agree with the findings reported by C. Le Pair et al. (Physica, 28: 305(1962)). Work is in progress on the determination of the terminal pressure of the solidification of He^3 solutions In He^4. (TTT)

8091 SURFACE TENSION, POTENTIAL AND DENSITY OF MOLTEN NIOBATES. A. I. Manakov, O. A. Esin, and B. M. Lepinskikh (Urals Section of the Academy of Sciences, USSR). Zh. Fiz. Khim., 36: 2317-21(Nov. 1962). (In Russian)

In contrast to CaO and Fe_2O_3, the oxides of potassium and cesium are surface active with respect to niobium pentoxide. Adsorbed Cs_2O and K_2O are oriented to the surface mainly with their oxygen anions and only to a very slight extent (3–5%) with the Cs^+ and K^+ cations. The molar volumes of the alloys are practically linear functions of the composition. The temperature coefficient of the surface tension of Nb_2O_5 and $K_2Nb_2O_6$ is negative, whereas that of V_2O_5 is positive. The thermal expansion coefficients of Nb_2O_5 and $K_2Nb_2O_6$ are considerable, appreciably exceeding even that of V_2O_5. (auth)

8092 ELECTRICAL DOUBLE LAYER IN MOLTEN SALTS. A. A. Ukshe, N. G. Bukun, and D. I. Leikis (All-Union Inst. of Aluminum and Magnesium, [Moscow]). Zh. Fiz. Khim., 36: 2322-8(Nov. 1962). (In Russian)

The results of measurements of the electrical double layer capacity of Cd, Pb, Sn, Sb, Bi, Tl, In, Al, and Mg in molten KCl–NaCl and KCl–LiCl mixtures are presented. In all cases the capacity–potential relation is expressed by a curve with a minimum situated near the zero charge potential of the metal. Such shape of the capacity curves is in agreement with the electrocapillary data and is probably due to deformation of the ions in the double layer, leading to sharp increase in capacity on shifting the electrode potential with respect to the zero charge point. (auth)

8093 TOPICS ON RADIOFREQUENCY SPECTROSCOPY. Proceedings of the International School of Physics, "Enrico Fermi." XVII Course. A. Gozzini, ed. New York, Academic Press, 1962. 319p. $10.00.

Fifteen papers are included. These cover such topics as masers and maser spectroscopy; atomic beams; frequency and time measurements by means of r-f spectroscopy; r-f spectra of optically oriented atoms; optical methods in magnetic resonance; optical pumping and detection; coherence phenomena in optical resonance; many-quantum resonances; E1 2-quantum resonances in gases; r-f spectroscopy; nuclear resonance in ferromagnets; double irradiation methods in magnetic resonance of liquids and gases; measurement of the electronic density at the position of the Li nucleus in metallic Li; magnetic resonance in Zn and Cd; and the ground states of alkali metals. (T.F.H.)

8094 DIRECT SHOCK TUBE MEASUREMENTS OF RECOMBINATION RATES: THE RECOMBINATION OF ATOMIC CHLORINE. T. A. Jacobs and R. R. Giedt (Aerospace Corp., Los Angeles). AIChE Preprint 153. New York, American Institute of Chemical Engineers, 1962. Prepublication Copy. 10p. $0.50.

By an extension of the ideas embodied in the single pulse shock tube, a technique has been developed which allows the direct measurement of recombination rates of many atomic species at high temperature. In the present technique the expansion chamber is located a few tube diameters from the shock tube end plate rather than at the high pressure end, as in the conventional single pulse shock tube. A cylindrical diaphragm, lying flush with the inside diameter of the tube, is used to control the time of initiation of an expansion wave. Experimental observation has shown that the present technique increases the gas expansion rate by an order of magnitude. The one-dimensionality of the flow at the shock tube end wall has also been investigated. By employing the developed technique in conjunction with the spectroscopic means of observation, preliminary measurements of the recombination rate of atomic chlorine have been conducted. (auth)

8095 CHEMI-IONIZATION AND ION-MOLECULE REACTIONS IN GASES. J. L. Franklin, M. S. B. Munson,

and F. H. Field (Humble Oil and Refining Co., Baytown, Tex.). ARS Preprint 2579-62. New York, American Rocket Society, 1962. Prepublication Copy. 63p. $1.00.

Recent developments in knowledge of ion-molecule reactions and chemi-ionization processes are summarized. Experimental methods of identifying a secondary ion and the reaction leading to the ion and methods of studying the kinetics of the reaction are reviewed. Mechanisms of formation of ions and reactions of excited ions are discussed. Many examples of ion-molecule and chemi-ionization reactions are cited. (A.G.W.)

8096 GENERATION AND MEASUREMENT OF HOMOGENEOUS FLUORESCENT AEROSOLS. K. T. Whitby, D. A. Lundgren, and C. M. Peterson (Univ. of Minnesota, Minneapolis). AIChE Preprint 27. New York, American Institute of Chemical Engineers, 1962. Prepublication Copy. 32p. $0.50.

Three aerosol generators capable of generating essentially homogeneous, monodisperse, spherical, and electrically neutral solid particles of fluorescent dye are described. These are an atomizer-impactor combination and two spinning-disk aerosol generators. The atomizer-impactor combination is capable of generating particles having geometric standard deviations between 1.3 and 1.5 with mass median diameters from 0.02 to 0.5 microns. This generator utilizes the all-metal Collison atomizer in series with a special impactor designed so that the droplet cutoff can be varied. High quality aerosols, having geometric standard deviations less than 1.1, within the size range from 0.5 to 3 microns, are generated by a 1.83-in.-diameter stainless steel spinning disk spun by an air motor from 20,000 to 70,000 rpm. The second spinning disk generator produces aerosols from 4 to 30 microns by means of a synchronous motor and a geared pully driving a 3.25-in. disk at a speed of 7,200 rpm. During the development of these generators it was found that the particles were electrically charged to substantial fraction of their maximum equilibrium charge. All three aerosol generators incorporate a noval ion generator and neutralization system which reduces the charge to a negligible level. A summary of the physics of aerosol charge neutralization is given. Essential operation variables, aerosol properties, and certain application problems are also discussed. (auth)

8097 IONIZATION MECHANISM AND ION POPULATION IN FLAMES. Nalin R. Mukherjee (Aerospace Corp., El Segundo, Calif.). ARS Preprint 2584-62. New York, American Rocket Society, 1962. Prepublication Copy. 31p. $1.00.

Probable chain reactions in aliphatic hydrocarbon flames and mechanisms for the formation of the most abundant ion and free electrons are discussed. Kinetic analyses of these reactions are given. A steady-state analysis of reactions reveals certain conditions that must be fulfilled for the most abundant ion formation. A semi-theoretical method on the basis of the absolute reaction rate theory is used to calculate the population of the most abundant ion. Experimentally determined concentrations are compared with the calculated concentration of propane-air, ethylene-air, and acetylene-air flames at pressures below one atmosphere. (auth)

8098 THE CHEMISTRY OF IONIZATION IN ROCKET EXHAUSTS. Felix T. Smith and Carole R. Gatz (Stanford Research Inst., Menlo Park, Calif.). ARS Preprint 2581-62. New York, American Rocket Society, 1962. Prepublication Copy. 19p. $1.00.

Theoretical and experimental studies contributing to the understanding of ionization in rocket exhausts are reviewed. Sources of ionization discussed include thermal ionization of atoms and solid particles and ion-producing interactions between the exhaust gases and the ambient atmosphere. Non-equilibrium effects in the rapidly expanding exhaust gases are also considered. (auth)

8099 A SURVEY OF FLAME IONIZATION WORK AT THE UNIVERSITY OF CAMBRIDGE. T. M. Sugden (Cambridge Univ., Eng.). ARS Preprint 2580-62. New York, American Rocket Society, 1962. Prepublication Copy. 22p. $1.00.

An account is given of the development of work on ionization in flames over the past fifteen years. The opportunity is taken to re-assess some of the earlier work in the light of new information about chemical reactions in flames. The paper begins with an account of the experimental methods used for measuring electrical conductivity of flames—the microwave attenuation and resonant cavity techniques—and the mass spectrometric system produced for the separation and analysis of positive ions in flames. Brief discussions of equilibrium ionization and of the fundamentals of flame chemistry precede the description of the results. The natural ionization of hydrocarbon flames is interpreted in terms of the mechanism suggested by Calcote, in which the primary step is the reaction of CH radicals with O atoms to give CHO^+ and a free electron. New information in support of this theory is given. The discussion of this kind of chemi-ionization is followed by an account of transfer of such ionization from molecular ions to give certain metallic atomic ions, thereby retarding the recombination process. The final section deals with the ionization of alkali elements in flames, and short accounts are given of the conditions under which equilibrium ionization is achieved, the rate at which it is set up, and the anomalous disturbances in electron concentration induced by the addition of small amounts of halogen in the presence of alkali metals. (auth)

8100 CONDUCTIVITY PROBE MEASUREMENTS IN FLAMES. R. A. Olson and E. C. Lary (United Aircraft Corp., East Hartford, Conn.). ARS Preprint 2592-62. New York, American Rocket Society, 1962. Prepublication Copy. 16p. $1.00.

An electrodeless probe has been developed to measure the electrical conductivity of high-temperature gases or flames. The weak interaction of an r-f field with a plasma is employed to measure the conductivity in the immediate vicinity of the probe. The probe overcomes the principal difficulties associated with techniques employing electrodes or microwaves, and is generally applicable to subsonic flows. Values of conductivity in the range of 0.04 to 0.27 mho/m have been detected with the probe in traversing an alkali-seeded hydrogen-oxygen flame. The same probe has shown a linear response to the conductivity of electrolytic solutions of up to 40 mho/m. (auth)

8101 IONIZATION PHENOMENA IN FLAMES. A. Van Tiggelen (Université, Louvain, Belgium). ARS Preprint 2582-62. New York, American Rocket Society, 1962. Prepublication Copy. 23p. $1.00.

Research on ionization in flames carried out during the past five years is summarized. The three main problems considered are as follows: (1) development of an adequate method of measuring the amount of ionization in the reaction zone of the flame; (2) identification of the ions formed in the flame front; (3) determination of the mechanism of ion formation. (A.G.W.)

8102 THE CRYSTAL STRUCTURE OF TETRASODIUM TETRAKIS-OXALATO ZIRCONATE (IV) TRIHYDRATE. Gerald Leonard Glen. Thesis, Ithaca, N. Y., Cornell Univ., 1962. 99p.

The crystal structures of the isomorphous compounds, $Na_4[M(C_2O_4)_4] \cdot 3H_2O$, where M(IV) = Zr, Hf, were determined. The common space group is $B22_12$, and the unit cell dimensions are: $Na_4[Zr(C_2O_4)_4] \cdot 3H_2O$; a = 7.42 Å, b = 11.81 Å, and c = 19.74 Å, $Na_4[Hf(C_2O_4)_4] \cdot 3H_2O$; a = 7.43 Å, b = 11.85 Å, and c = 19.76 Å. Intensity data of the zirconium compound were measured with a spectrometer equipped with a single crystal orienter and a scintillation counter. The coordinates of the heavy atoms, as well as approximate coordinates of the inner coordination group of oxygen atoms were determined from a Patterson synthesis of the complete $hk\bar{l}$ $|F|^2$ data. The positions of the remaining light atoms were determined from partial three-dimensional Fourier syntheses. Final refinement of the atomic parameters of $Na_4[Zr(C_2O_4)_4] \cdot 3H_2O$ was accomplished by the use of F_o and F_c Fourier syntheses. The isostructural character of the zirconium and hafnium compounds was established from photographic data plus a partial analysis of (010) (visually estimated) intensity data of the hafnium compound. The configuration established for $Zr(C_2O_4)_4^{4-}$ (and the virtually isodimensional $Hf(C_2O_4)_4^{4-}$) is the dodecahedral or $Mo(CN)_8^{4-}$ configurational type. The twofold axis required of $Zr(C_2O_4)^{4-}$ by the space group coincides with the 4-axis of the idealized $Mo(CN)_8^{4-}$ configuration. All the carboxyl groups and oxalate rings are flat within experimental accuracy. The most obvious deviation from 4m2 symmetry is in the angle between the mean planes of the ring systems: 1.3° from an exact right angle. Averaged bond distances are Zr–O, 2.197; C–C, 1.53; C–O, 1.29, and 1.225 Å for bonds lying, respectively, within and external to the rings. Averaged bond angles within the rings are 71.5° at zirconium, 120.4° at oxygen, and 113.6° at carbon. The O–Zr–O angle between adjacent rings in the same plane is 70.0°. Two of the sodium ions are located on twofold axes and one is in a general position. All are surrounded by rather irregular coordination figures consisting of oxygen atoms, varying in number from six to eight. The water molecules fill out the coordination group of sodium ions. Although there are four hydrogen atoms available for hydrogen bonding, there is evidence for but one distinct hydrogen bridge. This O–H . . . O hydrogen bond links a water molecule to one of the carboxyl atoms. (Dissertation Abstr., 23: No. 5, Nov. 1962)

8103 SOLUBILITY OF CESIUM IN LITHIUM AT ELEVATED TEMPERATURES. T. R. Cuerou (Republic Aviation Corp., Farmingdale, N. Y.) and F. Tepper. ARS Preprint No. 2537-62. New York, American Rocket Society, 1962. Prepublication Copy. 5p. $1.00.

A prime requirement of a direct-fluid-contact heat-exchange cycle for auxiliary power or propulsion use in space is relative insolubility of the working fluid (cesium) in the primary reactor coolant (lithium). Experimental solubility apparatus and test data are described, for temperatures ranging from 1400 to 2000°F. Cesium is found to be relatively insoluble in lithium up to 2000°F. (auth)

8104 PLUTONIUM COMPOUND. (to United Kingdom Atomic Energy Authority). French Patent 1,266,315. May 29, 1961.

The patent relates to a nuclear fuel material, comprising a compound of Pu having the perovskite structure and having the formula $MPuO_3$ (M = Ba) or $PuMO_3$ (M = Al, V, Cr, or Mn). The compounds are prepared by heating PuO_2 with the relevant metal oxide, carbonate, or hydroxide. (NPO)

8105 IMPROVEMENT IN THE PREPARATION OF REFRACTORY PRODUCTS, OBTAINED BY SOLID STATE REACTION, ESPECIALLY URANIUM NITRIDES. (to Commissariat à l'Energie Atomique). French Patent 1,267,860. June 19, 1961.

Uranium mononitride or uranium/uranium mononitride cermets are prepared by mixing uranium powder and a pulverized higher uranium nitride having a U/N ratio of 1.60 to 1.65, and sintering this mixture in a graphite sleeve at 800 to 1500°C under a mechanical pressure of 150 to 500 kg/cm². (NPO)

8106 METHOD OF PREPARING URANIUM CARBIDE AND APPLICATION OF THE PRODUCTS OBTAINED. (to Deutsche Gold- und Silber-Scheideanstalt). French Patent 1,276,460. Oct. 9, 1961.

Uranium monocarbide fuel compacts are prepared by submitting compacts of uranium oxide and graphite to the action of an electric arc at a temperature above 2450°C in a graphite furnace, the gas pressure in the furnace being kept constant and above 0.1 atm. (NPO)

8107 METHODS AND APPARATUS FOR THE OBTAINMENT OF URANIUM FLUORIDE. Paul Vertès, Jean Sauteron, and Maurice Delange (to Commissariat à l'Energie Atomique). U. S. Patent 3,069,227. Dec. 18, 1962. Priority date June 18, 1954, France.

Uranium dioxide pellets travel downward in a vertical reactor through a stream of gaseous hydrofluoric acid moving upward. The pellets are not disintegrated by swelling during the reaction. Uranium fluoride is continuously collected at the bottom of the reactor in the form of pellets. (R.J.S.)

8108 METHOD OF MAKING SPHERICAL ACTINIDE CARBIDE. George D. White and Dennis C. O'Rourke (to U. S. Atomic Energy Commission). U. S. Patent 3,070,420. Dec. 25, 1962.

This patent describes a method of making uniform, spherical, nonpyrophoric UC. UO_2 and carbon are mixed in stoichiometric proportions and passed through a plasma flame of inert gas at 10,000 to 13,000°C. (AEC)

Organic Chemistry

8109 APPLICATION OF NUCLEAR MAGNETIC RESONANCE TO THE ISOTOPE ANALYSIS OF DEUTERATED ORGANIC COMPOUNDS AND THEIR EXCHANGE REACTIONS. N. P. Buu-Hoï, N. Van Bac, N. Dat Xuong, and Joseph Parello (CNRS, Gif-sur-Yvette, France). Bull. Soc. Chim. France, No. 8-9, 1747-8 (Aug.-Sept. 1962). (In French)

The measurement of the nuclear magnetic resonance of protons in deuterated molecules is a very precise method for determining not only the number of atoms of deuterium introduced, but also the exact site that the atoms occupy at the interior of the molecule examined. As an example, the study of α,β,γ-trideuterio-γ-dideuteriomethyl-γ-phenylbutyric acid, prepared by the desulfurizing deuteriolysis of β-(thianaphthenyl-3) acrylic acid, is reported. The measurement was made in a 50% carbon tetrachloride solution, and the "chemical" displacements are given in cycles with respect to the tetramethylsilane used as an internal standard. The results are shown in tabular form. It was also determined that this method can be used to answer questions on deuterium ⇌ hydrogen exchange during chemical reactions. (J.S.R.)

8110 VALENCE-BOND STUDIES OF THE DEPENDENCE UPON SUBSTITUENTS OF C^{13}–H AND Si^{29}–H COUPLING. Cynthia Juan and H. S. Gutowsky (Univ. of Illinois, Urbana). J. Chem. Phys., 37: 2198-2208 (Nov. 15, 1962).

An interpretation is presented for the additivity of substituent effects on the C^{13}–H coupling constant, which was previously observed in the high-resolution NMR spectra of substituted methanes. Each atom or group X is assigned a

characteristic "affinity" for s character in the carbon hybrid orbital of the C–X bond. Distribution of s character among the carbon orbitals in accord with the relative s affinities of the four substituents leads to the observed additivity relation provided that the total s character is conserved. The valence-bond approach used with the model gives a linear relation between the s character of the carbon hybrid orbital involved in the C–H bond (α_H^2) and the observed C^{13}–H coupling constant ($J_{CH} = 500\ \alpha_H^2$). Also, it allows the determination of the s character of the other carbon orbitals. The dependence of the s character of the C–X bond on the electronegativity of X is discussed in terms of electron spin and charge correlation. It is noted that the hybridization changes should affect not only J_{CH} but also J_{HH}, which is consistent with the observed proportionality between $J_{CH}(CH_3X)$ and the cis and trans H–H coupling constants in $CH_2=C^{13}HX$. The treatment developed for methanes was extended to J_{CH} in substituted ethylenes and to the Si^{29}–H coupling in silanes. For the former, introduction of the s-electron affinities, obtained from the values of $J_{CH}(CH_3X)$ observed for the substituted methanes, led to the result that $J_{CH}(CH_2=C^{13}HX) = J_{CH}(CH_2=CH_2) + \frac{4}{3}[J_{CH}(CH_3X) - J_{CH}(CH_4)]$. Values predicted in this manner are systematically larger than those observed, which implies that there is a small, negative π-electron contribution of 5 to 10 cps to $J_{CH}(CH_2=C^{13}HX)$. Such a contribution is compatible with current theories for proton and C^{13} hyperfine splittings in ESR spectra of free radicals. The Si^{29}–H coupling constants observed in substituted silanes exhibit large, systematic deviations from the simple additivity found in the methanes. The deviations are explicable qualitatively in terms of changes in the Si–H-bond polarity. (auth)

8111 THERMAL REACTIONS OF ISOBUTYL RADICALS. W. M. Jackson, J. R. McNesby, and B. deB. Darwent (Catholic Univ. of America, Washington, D. C.). J. Chem. Phys., 37: 2256-60(Nov. 15, 1962).

Deuterium labeled isobutane $(CH_3)_3CD$ was pyrolyzed to generate $(CH_3)_3C$ and $CH_3CD(CH_3)_2$ radicals. The competition between reactions was studied by isotopic analysis of the hydrogen, methane, and isobutene fractions. One reaction was found to be of negligible importance relative to the other reaction up to 540°C and it was concluded that previous estimates of k_5/k_4 (in the nondeuterated species) were too high by at least an order of magnitude. The expulsion of molecular hydrogen by isobutyl or t-butyl did not occur in competition with other unimolecular reactions of the radicals. (auth)

8112 TEMPERATURE DEPENDENCE AND DECAY TIMES OF Eu^{3+} EMISSION LINES IN Eu DIBENZOYLMETHANE. Eran Nardi (The Ministry of Defence Atomic Energy Commission, Soreq Establishment, Israel) and Shaul Yatsiv. J. Chem. Phys., 37: 2333-5(Nov. 15, 1962).

The temperature dependence and the decay times of the Eu^{3+} fluorescence in DBM provide an unequivocal assignment for the emitting states. The decay times of emissions from the two excited states are due to different depleting mechanisms. The role of the particular J values of the two emitting states in Eu^{3+} is discussed. (auth)

8113 IONIZATION OF THE METHANE MOLECULE BY ELECTRON IMPACT. Mitio Inokuti (Northwestern Univ., Evanston, Ill.). J. Chem. Phys., 37: 2387-93(Nov. 15, 1962).

The cross section for ionization of the methane molecule by impact of fast electrons is evaluated by means of the Born approximation. Use is made of a single-configurational wave function set up from analytic one-center MO's for the description of the electronic ground state of the molecule. The wave function of the ejected electron resulting from ionization is approximated by a Coulomb continuum function. The calculated cross section is compared with experiment. The calculated momentum distribution of the ejected electron has a maximum at a very low momentum. (auth)

8114 MICROWAVE SPECTRUM, BARRIER TO INTERNAL ROTATION, QUADRUPOLE COUPLING CONSTANTS OF trans-1-CHLOROPROPYLENE. Robert A. Beaudet (Harvard Univ., Cambridge, Mass.). J. Chem. Phys., 37: 2398-2402(Nov. 15, 1962).

The microwave spectra of two isotopic species of trans-chloropropylene, $CH_3CH=CHCl^{35}$ and $CH_3CH=CHCl^{37}$, were measured and assigned. The quadrupole coupling constants of the chlorine[35] nucleus were determined from the hyperfine structure. A few transitions were further split by the linear effect of the barrier to internal rotation of the methyl group. From the separations the barrier height was measured to be 2170 ± 100 cal/mole. (auth)

8115 THE MECHANISM OF ENERGY TRANSFER IN LIQUID ORGANIC SCINTILLATOR SYSTEMS. W. Stolz (Technische Universität, Dresden). Kernenergie, 5: 668-75(Sept. 1962). (In German)

Investigations on the concentration dependence of the fluorescent intensity and decay time in multi-component organic scintillator systems were described. In addition to the determination of a series of significant parameters, conclusions were drawn with respect to the special nature of energy transfer from the solvent to the primary scintillator or from the primary scintillator to the secondary scintillator. (tr-auth)

8116 ULTRA-VIOLET ABSORPTION SPECTRA OF SIMPLE ALIPHATIC GUANIDINES. I. Szilágyi, T. Vályi-Nagy, and T. Keresztes (Research Inst. of Experimental Medical Sciences, Hungarian Academy of Sciences, Debrecen). Nature, 196: 376-7(Oct. 27, 1962).

The experimental conditions on the basis of which aliphatic guanidines can be directly determined at their absorption maxima are developed. (L.T.W.)

8117 CATALYTIC TRITIUM LABELING ATTRACTIVE FOR ORGANICS. John L. Garnett (Univ. of New South Wales, Sydney). Nucleonics, 20: 86; 88-91(Dec. 1962).

The investigation of over 300 compounds during the past six years indicates that a catalyzed exchange reaction is the preferable method for labeling a large number of organic compounds, particularly aromatics, with tritium. The reaction involves a tritium-hydrogen exchange between the organic compound and tritium oxide in the presence of a transition-metal catalyst. (R.J.S.)

8118 THE DEUTERIUM ISOTOPE RATE EFFECT IN FREE RADICAL REACTIONS OF t-CARBON DEUTERATED DDT AND ITS ANALOGS. Andrew Conrad Dachauer. Thesis, New York, Fordham Univ., 1962. 120p.

DDT and several of its analogs were synthesized with deuterium in the t-carbon position so that any chemical reaction involving this site in the molecule would then be subject to the deuterium isotope rate effect. Lithium aluminum deuteride, used as the source of the deuterium, was employed to reduce trichloromethyl p-chlorophenyl ketone, trichloromethyl p-bromophenyl ketone, and trichloromethyl p-methoxyphenyl ketone to the corresponding alcohols. The alcohols were then condensed with chlorobenzene, bromobenzene, and anisole respectively to form 1,1,1-trichloro-2,2-bis(p-chloro-phenyl)ethane-2-d (d-DDT), 1,1,1-trichloro-2,2-bis(p-bromophenyl)ethane-2-d (d-DBrDT), and

1,1,1-trichloro-2,2-bis(p-methoxyphenyl)ethane (d-methoxychlor). The deuterated and non-deuterated insecticides were identical in physical appearance and melting points. Infrared spectra showed significant differences; in particular, each deuterated compound had a distinctive band at ca 10.5 μ, missing in the spectra of the non-deuterated insecticides. NMR analysis confirmed the tertiary position of the deuterium and gave proof of high isotopic purity, each insecticide being 98% deuterated in the desired site. The isotope rate effect was first studied in the reaction of DDT, methoxychlor, and their deuterated analogs with alcoholic sodium hydroxide. The base catalyzed dehydrohalogenation showed an isotope rate effect, k_H/k_D, of the order of 5.4 for DDT and 6 for methoxychlor. The results were considered to be of a magnitude sufficient for the isotope rate effect to be manifested in the in vivo studies. The insecticides and their deuterated analogs were tested for toxicity on houseflies. The results showed that d-DDT and d-DBrDT were more toxic than their non-deuterated counterparts by a factor of ca 1.5 while d-methoxychlor showed a toxicity equal to methoxychlor. The results are explained on the basis of the detoxication process in the insects. In vitro studies showed that DDT-dehydrochlorinase, an enzyme capable of detoxifying DDT, manifested the isotope rate effect. It appeared, therefore, that in the detoxication process, the deuterated insecticide reacted more slowly, and though the initial dose given to the insect was less than that of the non-deuterated insecticide, the amount reaching the susceptible site in the insect was the same. The data support the view that at least one mode of resistance to DDT is chemical in nature and that the tertiary carbon-hydrogen group is involved. The data also indicated that susceptible houseflies contain some mechanism that can detoxify DDT and that this detoxication is chemical and subject to the isotope rate effect. (P.C.H.)

8119 REFINING FLUORINATED COMPOUNDS. A. L. Linch (to U. S. Atomic Energy Commission). U. S. Patent 3,071,628. Jan. 1, 1963.

This invention relates to the method of refining a liquid perfluorinated hydrocarbon oil containing fluorocarbons from 12 to 26 carbon atoms per molecule by distilling between 150°C and 300°C at 10 mm Hg absolute pressure. The perfluorinated oil is washed with a chlorinated lower aliphatic hydrocarbon, which maintains a separate liquid phase when mixed with the oil. Impurities detrimental to the stability of the oil are extracted by the chlorinated lower aliphatic hydrocarbon. (AEC)

8120 URANIUM COMPOUNDS AS CATALYSTS IN A PROCESS FOR PREPARING ESTERS. Brian W. Pengilly (to Goodyear Tire and Rubber Co.). U. S. Patent 3,072,612. Jan. 8, 1963. Filed Aug. 6, 1958.

A method is described of preparing linear superpolyesters by the alcoholysis of esters of polycarboxylic acids with a glycol and the subsequent polymerization of these glycol esters to high polymeric linear polyesters. Uranium compounds are used to catalyze the ester interchange reactions. (R.J.S.)

Radiation Chemistry and Radiochemistry

Refer also to abstracts 7713 and 7714.

8121 (BNL-6032) THE THERMAL DECOMPOSITION OF IRRADIATED α-LEAD AZIDE. Joseph Jach (Picatinny Arsenal, Dover, N. J. and Brookhaven National Lab., Upton, N. Y.). [nd]. Contract [AT(30-2)-Gen-16]. 36p.

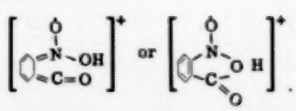
The thermal decomposition of unirradiated and heavily reactor irradiated colloidal α-PbN_6 was studied in the temperature range 195 to 253°C and 173 to 239°C, respectively. The irradiation vastly reduces the induction and acceleratory periods found with unirradiated material and increases the maximum rate and the rate of the final decay. The maximum rate normally occurs at about 40% decomposition but is shifted to approximately zero time on irradiation. The change in decay rate on irradiation is demonstrated by the two rate constants for decay, k (unirradiated) = $10^{12.0 \pm 1.0} \exp(-36.3 \pm 2.3$ kc/m/RT) and k (irradiated) = $10^{7.9 \pm 1.0} \exp(-25.7 \pm 2.4$ kc/m/RT). The significant drop in activation energy is possibly associated with changes in electronic excitation energies, while the drop in frequency factor is thought to result from gross structural changes accompanying the irradiation. The power laws observed in the acceleratory region are interpreted in terms of simultaneous surface and 3-dimensional reactions. (auth)

8122 (BNL-6079) FISSION FRAGMENT ENERGY DEPOSITION EFFICIENCY. Meyer Steinberg (Brookhaven National Lab., Upton, N. Y.). Mar. 1962. Contract [AT(30-2)-Gen-16]. 16p.

The calculation of the efficiency of deposition of kinetic energy of the recoiling fission fragments is discussed, and equations are given for the range of fission fragments in various substances. The overall energy deposition efficiency ϵ_θ for any combination of fuel and chemical system is given by $\epsilon_\theta = \epsilon_{KE}\epsilon_{SC}\epsilon_{EC}$, where ϵ_{KE} = fraction of total fission energy as kinetic energy (0.84 for fission fuels), ϵ_{SC} = self-absorption efficiency or fraction of energy escaping the parent fuel particle, and ϵ_{EC} = non-re-entry efficiency. Efficiency vs fuel dimension curves are given for the ϵ_{SC} in spherical, cylindrical, and slab geometries of solid U_3O_8; $\epsilon_{SC}\epsilon_{EC}$ for an ordered array of infinite slabs; ϵ_θ of various U_3O_8 geometries in air at 60 atm and 482°C; $\epsilon_{SC}\epsilon_{EC}$ for U_3O_8 spheres in gases with various fission fragment ranges; and $\epsilon_{SC}\epsilon_{EC}$ for UO_2 slurry in water. (D.L.C.)

8123 (BNL-6161) FREE RADICALS FORMED ON U. V. IRRADIATION OF o-NITROBENZALDEHYDE. P. Coppens and A. J. Tench (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT(30-2)-Gen-16]. 8p.

Studies were carried out on the photochemical rearrangement of o-nitrobenzaldehyde to nitrosobenzoic acid. Photolysis was conducted within the microwave cavity of an EPR spectrometer, and free radicals were found for both powder and solutions of o-nitrobenzaldehyde in ethanol and isopropanol. Similar free radicals were obtained in irradiated o-nitrocinnamic acid and o-nitrobenzylalcohol, which undergo rearrangement, but not in irradiated nitrobenzene and o-nitrobenzoic acid. The kinetics of the free radical in o-nitrobenzaldehyde solutions indicate that it is not an intermediate but is connected with the rearrangement in some way. Comparison of the EPR spectra with that of the negative ion of o-nitrobenzaldehyde indicates that the free radical has the structure



(D.L.C.)

8124 (BNL-6607) PRODUCTION OF Mg^{28}—STATE OF THE ART. Allen J. Weiss and Manny Hillman (Brook-

haven National Lab., Upton, N. Y.). [1962]. Contract [AT (30-2)-Gen-16]. 16p.

Methods used in the production of Mg^{28} by nuclear reactions are reviewed. (M.C.G.)

8125 (JAERI-1036) SEPARATION OF TECHNETIUM FROM NEUTRON IRRADIATED MOLYBDENUM. Kaoru Ueno and Chau-Ting Chang (Japan Atomic Energy Research Inst., Tokyo). 1962. 5p.

A separation procedure for Tc^{99} using tetraphenylarsonium chloride was studied. It was found that Mo^{99} can be removed in a 5% ammonia–0.1 M tetraphenylarsonium chloride–chloroform system. By this method, pure Tc^{99} can be quantitatively separated from neutron-irradiated Mo. (J.R.D.)

8126 (MITNE-21) THE IRRADIATION OF SANTOWAX OMP IN THE M.I.T. IN-PILE LOOP. PART I. SUMMARY TO OCTOBER 5, 1961. D. T. Morgan and E. A. Mason (Massachusetts Inst. of Tech., Cambridge). May 1962. Contract AT(10-1)-1067. 167p. (IDO-11104)

An operational in-pile loop in the M.I.T. nuclear reactor is now available for testing organic materials suitable for use as moderator-coolants in nuclear reactors. A detailed description of the loop is presented. The first in-pile irradiation using Santowax OMP as the test material was started on August 9, 1961. The physical and chemical properties of the irradiated Santowax OMP are presented, covering the irradiation period up to October 5, 1961. During this period, the concentration of radiolytic degradation products in the coolant increased from ~0 to 39 wt %. Forced convection heat transfer measurements were made throughout the irradiation period and correlations of the data are presented. The use of Wilson's method for the study of fouling is also discussed and illustrated, using the heat transfer data. Extensive calorimetric measurements of the dose rate in the position occupied by the in-pile section of the loop were made, using a special adiabatic calorimeter developed for this purpose. Based on these results, the fast neutron and the gamma dose rates in any organic material of known composition can be estimated. Measurements of the thermal, epithermal, and fast neutron fluxes were also made, both before and after installation of the in-pile section of the loop in the reactor, using neutron-absorbing foils. Based on these dose rate measurements and the measured concentrations of each terphenyl isomer in the coolant, the decomposition yields were found to be:

$$G^*(-i) = \frac{G(-i)}{C} = 0.28 \pm 0.03 \frac{\text{molecules of component i degraded/100 ev absorbed}}{\text{wt fraction of component i}}$$

for each of the terphenyl isomers. $G^*(-i)$ is not significantly affected by the concentration of degradation products. This, as well as the other results of this investigation, to date, were generally similar to those reported previously for Santowax R at the same temperature and thus generally support the reactor design studies reported. (auth)

8127 (N62-11728) RECOMBINATION AND MOBILITY OF NUCLEAR RADIATION INDUCED IONIZATION IN LIQUID HYDROGEN. N. Zessoules, J. Brinkerhoff, and A. Thomas (Tracerlab, Inc., Waltham, Mass.). Feb. 1962. Contract NASr-20. 19p.

To test whether an applicable theory for ion collection in gases could be adapted to ion collection in cryogenic liquids, a stationary radioactive source (Kr-85) was allowed to produce ionization at a particular location in a flowing stream of liquid hydrogen. The ionization collected at various points downstream for various velocities was measured for independent determination of the recombination coefficient and the ionic mobility. The behavior of nuclear radiation induced in liquid hydrogen was found to follow the ordinary laws of recombination and mobility, with the exception that only a small portion, around 2×10^{-4}, of the initially formed ionization is available for "volumetric" recombination; the remainder disappears relatively instantaneously. The values of recombination coefficient and ionic mobility were found to bear a relationship similar to that for atmospheric gases, viz., $\alpha \simeq 4 \pi e \mu$, and to have individual numerical values in qualitative agreement with those expected on the basis of a simple inverse dependence on density. (auth)

8128 (N62-12368) EFFECTS OF NUCLEAR RADIATION IN A LIQUID HYDROGEN MEDIA. PART I. FINAL SHAKE-DOWN OF CRYOGENIC APPARATUS. N. Zessoules. PART II. DATA ANALYSIS. N. Zessoules and J. Brinkerhoff. PART III. CALCULATION OF SOURCE STRENGTH. A. Thomas. Quarterly Report No. 4, October 1, 1961–March 27, 1962. (Tracerlab, Inc., Waltham, Mass.). Contract NASr-20. 31p.

Major modifications and additions to the cryogenic equipment were completed. It was established that ionization, induced by a radioactive source in a flowing stream of liquid hydrogen, can be detected downstream as an ionization current. From data that relate the plate current to the applied voltage and the ionization current to flow velocity, it was possible to measure independently the ionic mobility and the recombination coefficient; furthermore, the fraction of the volumetric ionization rate was estimated that is available for volume recombination and production of ion current. (auth)

8129 (NYO-10185) EVALUATION OF BETA RADIATION AS A HYDROGENATION CATALYST. Quarterly Technical Status Report No. 2, June 1, 1962–August 31, 1962. P. M. Yavorsky and E. Gorin (Consolidation Coal Co. Research and Development Div., Library, Penna.). Oct. 1, 1962. Contract AT(30-1)-2978. 17p.

Thirteen reference runs without radiation were completed, to supply a basis of comparison for the effect of radiation on hydrogenation reactions at high temperatures and pressures. Methylnaphthalene, biphenyl, and coal extract were hydrogenated with a contact catalyst and no catalyst at two different temperatures. A 90-curie internal source of Sr^{90} has been installed in the reactor. A radiation dose rate of 0.98×10^6 rad/hr is present inside the reactor. Radiation processing tests of hydrogenation of the same materials are about to proceed. (auth)

8130 (PAN-307/XVII) COMPARISON OF SOLID-STATE POLYMERIZATION OF ACRYLAMIDE AND METHACRYLAMIDE INDUCED BY γ-RADIATION. Janina Żurakowska-Orszagh (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Mar. 1962. 16p.

Solid-state radiation polymerization of acrylamide and methacrylamide in crystalline, powdered, and shock-cooled form was investigated. The influence of atmospheric oxygen was studied showing an inhibiting effect on the polymerization rate of acrylamide and an accelerating effect on methacrylamide. (auth)

8131 (PAN-310/XVII) GRAFTING OF ACRYLONITRILE ON CELLULOSE INDUCED BY γ-IRRADIATION. Andrzej Orszàgh, Jan Pieniażek, and Janina Żurakowska-Orszàgh (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Mar. 1962. 11p.

Radiation induced grafting of acrylonitrile onto cellulose in form of viscose yarn and "tomofan" foil was investigated using the in-source irradiation method. The influence of different techniques of grafting and of several solvents

and mixture of solvents used was studied showing the effect of water on the process of grafting. (auth)

8132 (PAN-311/XVII) INFLUENCE OF DIFFERENT INORGANIC ADDITIVES ON THE DEGRADATION OF POLYISOBUTYLENE UNDER THE INFLUENCE OF γ-RADIATION. Janina Żurakowska-Országh and Zofia E. Sobolewska (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Mar. 1962. 15p.

Investigations of the degradation of polyisobutylene were carried out by measuring the flow rate and viscosity at various temperature and stress. Compounds of polyisobutylene with inorganic additives such as talc, ZnO, and $CaCO_3$ were investigated. (auth)

8133 (PAN-346/V) FORMATION OF CHEMICAL PRODUCTS FOLLOWING $^{31}P(n,gamma)^{32}P$ REACTION IN TRI-, DI-, AND MONO-n-BUTYL PHOSPHATES. Andrzej Siuda (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). July 1962. 18p.

The formation of chemical products in tri-n-butyl phosphate (TBP), di-n-butyl phosphate (DBP), and mono-n-butyl phosphate (MBP) as a result of $P^{32}(n,gamma)P^{32}$ reaction was investigated. The percentage yields of P^{32} activity in TBP, DBP, MBP, and inorganic forms were determined. The influence of added scavengers and effects of phase change, dilution with n-butanol, and gamma dose were studied. It was found that in the presence of scavengers the products containing more organic rests than the target molecule, are not formed. On the basis of the experimental results the hypothesis is advanced that the formation of the products by the hot processes is mainly due to reaction of the recoil atom with the single medium molecule or with its fragmentation products. (auth)

8134 (PAN-347/XVII) THE RADIATION INDUCED OXIDATION AND REDUCTION REACTIONS OF IRON IN AQUEOUS SOLUTIONS. II. THE DIRECT OBSERVATIONS OF REDOX PROCESSES IN THE IRRADIATED $Fe-H_2SO_4$-ISOBUTYL ALCOHOL-H_2O-O_2 SYSTEM. Roman Broszkiewicz and Stefan Minc (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). July 1962. 6p.

The radioinduced reactions of ferrous and ferric ions in aqueous solutions were observed by means of the direct measurement of concentration during the irradiation. It was found that after the initial oxidation a steady state of Fe^{+3} is established, followed by radioinduced reduction. (auth)

8135 (RAI-311) A STUDY OF THE MECHANISM OF RADIATION-INDUCED GELATION IN MONOMER-POLYMER MIXTURES. May 1, 1961–October 31, 1962. George Odian and Bruce S. Bernstein (Radiation Applications Inc., Long Island City, N. Y.). Oct. 31, 1962. Contract AT(30-1)-2816. 75p.

It was found that the use of polyfunctional monomers can have a profound effect on the course of the radiation reactions of polymers. The radiation requirements for the crosslinking of polyethylene were reduced by using polyfunctional monomers. Polypropylene is inefficiently crosslinked by radiation. However, the use of polyfunctional monomers greatly increased the efficiency of the radiation-crosslinking of polypropylene. Polyisobutylene, unlike polyethylene or polypropylene, not only does not crosslink under irradiation, but is in fact degraded. The use of polyfunctional monomers reverses the normal radiation reaction, resulting in facile crosslinking. Similar results were obtained for cellulose acetate. The properties of the various monomer-crosslinked materials showed substantial improvements. In particular, the heat stability of polyethylene and polypropylene was significantly improved. (auth)

8136 (TID-17356) THE USE OF THE ORGANO-METALLIC BOND IN CHEMICAL RADIATION DOSIMETRY. Quarterly Report for Period Ending July 31, 1962. (Atlantic Research Nuclear Corp., Alexandria, Va.). Contract AT(30-1)-2979. 14p.

The dissociation characteristics of organometallic bonds in metal chelates are being examined. The study is being conducted to investigate the possibility of using dissociation measurements in radiation dosimetry. Solutions of Cr(III) and Co(II) chelates with acetylacetone (2,4-pentanedione) were irradiated with gamma radiation from Co^{60}. Subsequent to the irradiation, these solutions of complex compounds in organic solvents were extracted and analyzed. All irradiations were performed using 80 curies of Co^{60}. Analytical results are included. Plans are discussed for irradiation of samples with 500-curie sources. (J.R.D.)

8137 (TID-17583) THE EFFECT OF HIGH ENERGY RADIATION ON THE CRYSTAL GROWTH RATE. Edward A. Mason and Robert C. Reid (Massachusetts Inst. of Tech., Cambridge). Nov. 1962. Contract [AT(30-1)-906]. 38p.

The theories of crystal growth are reviewed, and the probable effects of radiation on crystals growing from solutions are discussed. It is believed that irradiation would increase the growth rate. A research program on radiation effects on crystal growth is outlined, in which succinic acid crystals will be used. (D.L.C.)

8138 (TID-17674) THE INTERACTION OF RADIATION WITH MATTER. Progress Report. (New York Univ., New York). Dec. 1962. Contract [AT(30-1)-2962]. 20p.

Research being carried out on the interaction of radiation with matter is reported. Topics covered include: x-ray photography with persistent internal polarization, time constant measurements and energy transfer, radical production and energy transfer in radiation chemistry and photochemistry, ionization energies of solids and liquids, theory of charged particle stopping in matter, and stopping power of organic films for alpha particles. (M.C.G.)

8139 (TID-17765) DEVELOPMENT OF KRYPTON 85 AS A UNIVERSAL TRACER. Sixth Quarterly Report, July 1 to September 30, 1962. (Parametrics, Inc., Waltham, Mass.). Contract AT(30-1)-2757. 34p.

A large number and variety of solid sources of Kr^{85} were prepared. Operating temperatures were pushed to 650°C and pressures to greater than 5000 psi. Good thermal stability was in evidence as high as 1000°C. Several reactive gas systems were studied for use of Kr^{85} in radiochemical analysis. The possibilities of radiokrypton homologs that can be applied as sensors for the detection and analysis of oxygen were investigated. The study of analysis in aqueous solutions was begun with the study of acid-metal kryptonate reactions. (M.C.G.)

8140 (UCRL-10577) ISOTOPIC STUDIES ON THE RADIATION DECOMPOSITION OF CRYSTALLINE CHOLINE CHLORIDE. Richard M. Lemmon and Margaret A. Smith (California. Univ., Berkeley. Lawrence Radiation Lab.). Dec. 1962. Contract W-7405-eng-48. 14p.

Carbon-14- and deuterium-labeled choline chlorides were used to study the mechanism of the radiolysis of crystalline choline chloride. These studies demonstrate that, during the highly-sensitive radiation decomposition, the carbinol group of the ethanol moiety becomes the aldehyde group of the resultant acetaldehyde, no hydrogens are transferred to or from the trimethylamino group, the hydrogens of the ethanol moiety are highly mobile, and intermolecular hydrogen transfers take place. (auth)

8141 THE EFFECT OF GAMMA RADIATION ON A NUMBER OF WATER SOLUBLE VITAMINS. Monica Sjoestedt and L.-E. Ericson (Royal Inst. of Tech., Stockholm). Acta Chem. Scand., 16: 1989-98(1962). (In English)

Solutions of thiamin hydrochloride, riboflavin, niacinamide, biotin, pteroylglutamic acid, and N_5-formyltetrahydropteroylglutamic acid were irradiated with γ rays from a Co^{60} source. Residual activity as well as the formation of biologically active breakdown products was studied using microbiological test systems. No microbial growth factors other than the vitamins themselves were detected in irradiated solutions of thiamin, riboflavin and niacinamide. Biotin-L-sulfoxide was formed on irradiation of biotin and pteroic acid on irradiation of pteroylglutamic acid. A great number of biologically active breakdown fragments were observed in irradiated solutions of N_5-formyltetrahydropteroylglutamic acid, amongst them pteroylglutamic acid, N_{10}-formylpteroic acid, pteroic acid, and N_{10}-formylpteroylglutamic acid as well as three chemically unidentified growth factors. It was noted that the degree of destruction as determined spectrophotometrically appeared to be considerably lower than found on microbiological estimation. (auth)

8142 THE EFFECT OF GAMMA RADIATION ON CYANOCOBALAMIN. Monica Sjoestedt and L.-E. Ericson (Royal Inst. of Tech., Stockholm). Acta. Chem. Scand., 16: 1999-2004(1962). (In English)

Solutions of cyanocobalamin were irradiated with various doses of γ rays from a Co^{60} source. A number of breakdown fragments that could replace the vitamin as growth factor for E. coli 113-3 were detected. Some of these fragments seem to possess activity also towards Ochromonas malhamensis. The types of biologically active breakdown products formed and the degree of loss of microbiological activity of irradiated solutions were found to depend on a number of conditions, e.g., the dose given, the ionic strength, pH, presence of reducing substances and so forth. In a 0.1 M phosphate buffer of pH 5.0 containing 5 mg cyanocobalamin per ml and given a dose of 2 Mrad, at least five compounds are formed that are growth factors for E. coli 113-3. (auth)

8143 THE pH-DEPENDENCE OF RADIOLYTIC PROCESSES IN DICHROMATE SOLUTIONS. I. Kósa-Somogyi, I. Kiss, and R. Schiller (Central Research Inst. for Physics, Hunagrian Academy of Sciences, Budapest). Acta Chim. Acad. Sci. Hung., 33: 143-51(1962). (In English)

5×10^{-4}M $K_2Cr_2O_7$ solutions in 0.8N sulfuric acid are completely reduced under the action of Co^{60} γ radiation. The yield of the radiolytical reduction is G = 0.8 ions/100 ev. The reduction process is considerably affected by the pH of the solution. A sharp break is observed in the reduction yield at pH = 2.5. The marked decrease in yield is attributed to the individual pH-dependence of the secondary processes involved in the radiolysis of water (decomposition of H_2O_2 formed as a result of HO_2 dissociation) as well as to the pH-dependence of the reduction processes of Cr(VI). The radiolytical reduction of dichromate solutions in the concentration range from 10^{-3} to 10^{-4}M $(Cr_2O_7)^{2-}$ in 0.8N sulfuric acid appears to be a first-order reaction, induced by the radical products of steady concentration formed in the radiolysis of water. The reducing and oxidizing processes attain equilibrium above the value pH = 4; consequently, the concentration of Cr(VI) remains virtually unchanged under the action of radiation. (auth)

8144 STUDIES ON THE RADIOLYSIS OF AQUEOUS POTASSIUM IODIDE SOLUTIONS. L. Botár and I. Safarik (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest). Acta Chim. Acad. Sci. Hung., 34: 377-82(1962). (In English)

Investigations were carried out to study the effect of H^+-ion concentration on the yield of iodine formed by irradiation in aqueous potassium iodide solutions. Results showed a slight increase in G(I) in the range of pH = 3.3 to 1.3, whereas with a further decrease in pH a sharp rise was to be observed. Explanations were attempted on the basis of radical theory, but in order to fully clarify the oxidation mechanism, further investigations seem to be necessary. (auth)

8145 CONFERENCE ON RADIATION-INDUCED CHANGES IN THE PROPERTIES OF MATERIALS. D. Vaisburd (Vaisburg) and Yu. Zakharov. At. Energ. (USSR), 13: 497-8(Nov. 1962). (In Russian)

Results of research work carried out at the Tomsk Polytechnic Institute, the Siberian Physico-Technical Institute and the Tomsk State University were reported at the meeting held during November 1961 in Tomsk under the participation of scientists from Moscow, Irkuts, Novosibirsk, Tashkent, and Tbilisi. The following scientific fields were involved: determination of radiation stability of materials as a function of chemical composition; physics of the radiation-induced deterioration and microprocesses; chemical effects of radiation; and design of apparatus and instruments for studying radiation effects. A. A. Borob'ev found that the radioinduced changes in ionic crystals are similar to those caused by plastic deformation: they involve increase of the stored energy and weaken the bond between particles resulting in an increase of the free energy of the system, manifested by an augmentation of crystal defects. A. V. Kuzmina measured the stored energy of NaCl exposed to γ radiation, finding it to be 1.47 cal/g. P. A. Savintsev, I. T. Berzina, A. A. Botaki, and A. F. Naumov found that irradiation of ionic crystals results in an increase of the diffusion rate, the thermal expansion coefficient and the dissolution rate and a decrease of Young's modulus. L. S. Sokolov discussed methods for measuring cyclotron beams used for irradiation studies. B. A. Kononov and V. I. Rudenko developed an apparatus for measuring the absorption coefficient of the electron beam of the betatron in crystals, making use of a calorimeter and an ionization chamber. (TTT)

8146 IRRADIATION OF AQUEOUS AROMATIC COMPOUNDS: THE BENZOIC-SALICYLIC ACID SYSTEM. J. H. Green, B. J. Ralph, and P. J. Schofield (Univ. of New South Wales, Kensington, Australia). Atompraxis, 8: 455-7(Dec. 1962). (In English)

In aqueous solution the benzene nucleus was hydroxylated by hydroxyl free radicals from the action of the ionizing radiation on the solvent. The three isomeric monohydroxy benzoic acids were formed from the irradiation of aqueous benzoic acid and the study of the formation and decomposition of one of the products, salicylic acid, indicated that the benzoic-salicylic acid system reacts as a typical large molecule system. Thus such a simple system may be used as a model for the study of the hydroxylation reaction for complex biological systems involving aromatic moieties. (auth)

8147 HOT-ATOM CHEMISTRY OF RADIOCHROMIUM IN POTASSIUM OXALATOCHROMATES. [PART] III. N. Saito, H. Sano, and T. Tominga (Tokyo Univ.). Chem. Ind. (London), 1796-7(Nov. 4, 1961).

The crystalline dl-$K_3[Cr(C_2O_4)_3]3H_2O$ and cis-$K[Cr(H_2O)_2 \times (C_2O_4)_2]2H_2O$ were irradiated for 1 to 5 hr at reactor temperature in the presence of air, at a thermal neutron flux of

$3-5 \times 10^{11}$ n/cm² sec. The radioactive Cr^{51} nucleus resulting from the reaction $Cr^{50}(n,\gamma)Cr^{51}$ may have a recoil energy up to a maximum of 880 ev, depending on the number and energies of the γ rays emitted. The irradiated salts were dissolved in water and the Cr^{51}-labeled species were separated by paper electrophoresis, ion exchange, or solvent extraction. The distribution of Cr^{51} activity was practically the same irrespective of the method employed. The total amount of Cr in each fraction was determined spectrophotometrically using the diphenylcarbazide method. A negligibly small fraction (<0.2%) of Cr^{51} appeared in the form of $Cr(C_2O_4)_3^{3-}$ when $K[Cr(H_2O)_2(C_2O_4)_2]2H_2O$ is irradiated, whereas a large fraction (40–52%) of Cr^{51} appears in the form of $Cr(C_2O_4)_2$ when $K_3[Cr(C_2O_4)_3]3H_2O$ is irradiated. (H.H.D.)

8148 EFFECT OF 40-kv X RAYS ON HYDROGEN PEROXIDE SOLUTIONS IN WATER IN TUBES OF LOW CAPACITY. Djafar Sirousse-Zia and Pierre Mergault (Laboratoire de Physique-Enseignement à la Sorbonne, Paris). Compt. Rend., 255: 1738-40(Oct. 8, 1962). (In French)

The quantity of hydrogen peroxide decomposed by the effect of x rays on hydrogen peroxide solutions of different initial concentration approaches a plateau when the initial concentration is very high. This shows that the order of the total radiodecomposition of hydrogen peroxide varies between 1 and 0, according to the initial concentration of the hydrogen peroxide. (tr-auth)

8149 CHANGES IN EPR SPECTRUM OF FREE RADICAL SPECIES IN γ-IRRADIATED POLYFORMALDEHYDE. R. Lenk (Nuclear Research Inst., Czechoslovak Academy of Science, Prague). Czech. J. Phys., 12: 833-7(1962). (In English)

It is found that gamma-irradiated polyformaldehyde (PFA) does not exhibit the effect of the "disappearance" of the hyperfine structure of EPR spectrum as a function of the dose or the time passed from the end of irradiation, as is observed for a group of polymers having only atoms in the polymer chain. This difference in the change in the EPR of the PFA spectrum compared with the polymers with a chain is explained by the impossibility of forming a conjugate double bond in the –C–O–C–O– chain in PFA. (auth)

8150 SPECIFIC FEATURES OF SOLID PHASE POLYMERIZATION IN THE CURVE OF IRRADIATION. I. M. Barkalov, V. I. Gol'danskii, N. S. Enikolopov, S. F. Terekhova, and G. M. Trofimova (Inst. of Chemical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk SSSR, 147: 395-8(Nov. 11, 1962). (In Russian)

In order to determine whether polymerization took place during irradiation or after the irradiation, samples of acrylonitrile (AN) and of vinylacetate (VA) were irradiated with 1.6-Mev electrons. Thermal effects of 10 to 40 cal/g could be detected calorimetrically to an accuracy of 1 cal/g. Electron paramagnetic resonance measurements were taken to observe the accumulation of radicals during the irradiation at various temperatures, and the disappearance of the radicals after the irradiation. The initial rate of polymerization of acrylonitrile is proportional to the dose rate ($W_{poly} \sim I^{0.8}$). A limiting yield of polymer is observed at high irradiation doses at temperatures below –140°C. Postpolymerization was observed at –140, –120, and –90°C, but was absent at lower temperatures. During irradiation, the molecular weight of the polymer decreased with increasing dose from $M = 3 \times 10^4$ to $M = 7 \times 10^3$ at a dose of 150 M rad. During the course of the postpolymerization period, the molecular weight of the polymer increased to $M = 10^6$ after 10 hours at –90°C. Most of the polymerization takes place in the solid phase during the irradiation. On irradiating vinylacetate, no postpolymerization could be detected in the solid phase. The heat of fusion was 34 cal/g. In general, the radiation behavior of vinylacetate was similar to that of acrylonitrile. (TTT)

8151 THE EFFECT OF X-RAYS ON THE ELECTROCHEMICAL OXIDATION OF ETHYL ALCOHOL AT A Pt ANODE. S. A. Brusentseva, D. V. Kokoulina, and P. I. Dolin (Inst. of Electrochemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 147: 649-52(Nov. 21, 1962). (In Russian)

Alcohol solutions 0.17 to 3.5M in H_2SO_4 were oxidized on a Pt anode (a wire ring 0.3 mm in diameter) in the presence of air and in the absence of air, while the solution was irradiated from without with a beam of x rays. Voltage and current relationships were followed with a polarograph. The unirradiated solutions showed the existence of two current maxima, which increased linearly with concentration of C_2H_5OH in the interval of 0.17 to 1.0M. Up to a dose of $\sim 5 \times 10^{19}$ ev/cm³, the current maxima decreased with increasing dose, when the irradiation was carried out in the absence of oxygen. On irradiation the 0.35M H_2SO_4 solution of alcohol in the presence of oxygen, the first current maximum hardly changed, but the second current maximum increased directly with dose up to a dose of 3×10^{19} ev/cm³. It was found that the addition of 0.5 to 3.0×10^{-4}M acetaldehyde decreased the magnitudes of the first and second current maxima, while the addition of hydrogen peroxide increased the magnitude of the second current maximum, but did not affect the first current maximum. The accumulation of aldehyde and peroxide in the irradiated solution was determined. The G yield of H_2O_2 was 4.4 mols/100 ev in the presence of oxygen, but in the absence of oxygen, the concentration of H_2O_2 fell to $\sim 0.5 \times 10^{-4}$M, and stayed constant at this value with further irradiation. Acetaldehyde was formed with a yield of 2.15 mols/100 ev both in the presence of oxygen and in the absence of oxygen. The observed effects can be explained by the formation of acetaldehyde and H_2O_2 as radiolysis products. (TTT)

8152 THE EFFECT OF IRRADIATING THE SOLID PHASE ON THE RECRYSTALLIZATION KINETICS OF POTASSIUM SULFATE. Vikt. I. Spitsyn and V. V. Gromov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 147: 663-6(Nov. 21, 1962). (In Russian)

Tagged K_2SO_4 crystals containing a constant amount of Ce^{141} (~0.08 mcs/g) and a variable amount of S^{35} (0, 0.5, and 50 mcs/g) were prepared by crystallizing K_2SO_4 from a Na_2SO_4 solution. The K_2SO_4 crystals were dried and sieved. One gram portions of the tagged K_2SO_4 salt (0.3 to 0.5 mm fraction) were added to 25 ml of saturated K_2SO_4 solution in 0.5 or 1.5N HNO_3. The mixture was then agitated at a temperature of 20°C. Samples of the supernatant liquid were taken at different time intervals in order to determine the Ce^{141} and S^{35} radiometrically. The recrystallization of K_2SO_4 was faster in 1.5N HNO_3 than in 0.5N HNO_3, and in all cases, the K_2SO_4 with the higher specific activity of S^{35} recrystallized more rapidly than the low-specific-activity K_2SO_4 salt. The distribution of Ce in the K_2SO_4 changed from a logarithmic distribution with $\lambda = 16$ to a linear distribution with $D = 16$ and 22 respectively, in the 1.5N HNO_3 and in the 0.5N HNO_3 solutions. The rate of redistribution of Ce between the high-specific-activity K_2SO_4 containing 50 mcs/g of S^{35} and the saturated 0.5N HNO_3 was significantly greater than it was with the low-specific-activity K_2SO_4 precipitate. This type of behavior

was not observed in the 1.5N HNO_3 solution. The effect of irradiation on the crystal lattice is to accelerate the recrystallization process. (TTT)

8153 PRACTICAL PRODUCTION YIELDS OF RADIONUCLIDES WITH 17 AND 21 Mev PROTONS. G. I. Gleason (Abbott Labs., Oak Ridge, Tenn.), I. J. Gruverman, and J. L. Need. Intern. J. Appl. Radiation and Isotopes, 13: 223-8 (May 1962). (In English)

The thick-target yield of Be^7, Na^{22}, Cr^{51}, Fe^{55}, Co^{56}, Co^{57}, Zn^{65}, and Cd^{109} is measured for both high-current production runs in the internal beam of a cyclotron and for external-beam irradiations. For all isotopes the yields are greater for the external irradiations. The targets used for the internal-beam runs are described. Reasons for the variation in yield are discussed, with particular attention to the possibility of diffusion of the active material from the target during the irradiation. (auth)

8154 THE MECHANISM OF RADIATION-INDUCED GRAFT COPOLYMERIZATION. H. W. Chandler (Columbia Univ., New York), E. J. Henley, and E. N. Trachtenberg. Intern. J. Appl. Radiation and Isotopes, 13: 239-46(May 1962). (In English)

The kinetics of the radiation-induced grafting of pure styrene, pure acrylonitrile, and mixtures of the two to polyethylene (PE) was studied. In particular, the following factors were investigated: film thickness; composition of monomer mixtures; dose rate; and temperature. The rate of grafting of mixtures of styrene and acrylonitrile goes through a maximum as the composition of the mixture changes, the position of the maximum varying as the film thickness changes. The calculated k_p^2/k_t (k_p and k_t are the specific propagation and termination rate constants respectively) for the grafting of styrene to PE is approximately a thousand times as great as the value obtained in homogeneous polymerization. It is deduced that both k_p and k_t are lower in polymer-monomer systems than in homogeneous phases. (auth)

8155 A Co^{60} GAMMA IRRADIATOR FOR CHEMICAL RESEARCH. R. J. Hanrahan (Univ. of Florida, Gainesville). Intern. J. Appl. Radiation and Isotopes, 13: 254-5 (May 1962). (In English)

A stationary irradiator is described that incorporates the following design features: it is shielded in all directions except downward, so it can be used in most ground-floor locations; it is entirely encased in welded steel for fire protection; and it has a source storage turret that serves as a shipping container. The source can have activities upward of 400 C. With a 400-C source the available dose rates range from 3 kr/hr to 2.4 Mr/hr, depending on the nature of the irradiated sample. (T.F.H.)

8156 Sr^{90}–Y^{90} β-SOURCES FOR RADIATION CHEMISTRY STUDIES. J. L. Haybittle (Addenbrooke's Hospital, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 263-4(May 1962). (In English)

Bremsstrahlung dose rates and shielding requirements are calculated for multicurie Sr^{90}–Y^{90} beta sources. (T.F.H.)

8157 MASS SPECTRA OF MOLECULES AND RADIATION CHEMISTRY. N. N. Tunitskii, S. E. Kupriyanov, and A. A. Perov. Izv. Akad. Nauk SSSR, Otd. Khim. Nauk, No. 11, 1945-52(Nov. 1962). (In Russian)

Characteristics of molecular dissociation as a function of the energy and properties of bombarding particles were analyzed. Studies of the dissociation spectra of CH_4^+ at 3.5 kev in single collisions with molecules showed the spectra to be similar to the ordinary methane mass spectra at an electron energy of 70 ev. Collisions of fast ions (several kev) induce a deeper dissociation, for corresponding molecules, than electrons of several dozen ev to 12 kev. The excitation energy of molecular and fragment ions produced by electron shock is near the dissociation energy. The rate of molecular dissociation and correlations between the mass spectra and radiolysis yield are analyzed. (R.V.J.)

8158 ELECTRON MAGNETIC RESONANCE OF X-IRRADIATED POTASSIUM HYDROGEN MALEATE. H. C. Heller and T. Cole (Ford Motor Co., Dearborn, Mich.). J. Am. Chem. Soc., 84: 4448-51(Dec. 5, 1962).

X irradiation of a single crystal of potassium hydrogen maleate HOOCCH=CHCOOK was found to produce a free radical in which the unpaired electron interacts with only two protons. The electron magnetic resonance of this radical, shown to be $^{\cdot}OOCCH=CHCOO^-$, indicates that it is oriented in the host crystal in the same way as the parent hydrogen maleate ion. The principal values of the proton hyperfine tensors of the radical are: −19.0, −28.4, and −6.0 Mc. The rather small principal values and their directions indicate that the unpaired electron in the radical is in a $p\pi$ orbital delocalized over the whole radical, including the carboxyl groups. The directions of the principal values are in agreement with the cis-structure of the parent molecule. The utilization of emr spectra in differentiating between cis- and trans-structures of radicals is briefly discussed. (auth)

8159 THE SECONDARY DEUTERIUM EFFECT IN CH_3 AND CF_3 ADDITION REACTIONS. M. Feld, A. P. Stefani, and M. Szwarc (Syracuse Univ., N. Y.). J. Am. Chem. Soc., 84: 4451-3(Dec. 5, 1962).

The secondary deuterium effect was investigated for the CH_3 and CF_3 addition reactions. The results obtained for the relevant k_D/k_H were $CD_3=CD_2=1.05$ for CH_3, 1.07 for CF_3, $CH_3CH=CD_2=1.12$ for CH_3, 1.07 for CF_3, $CD_3CD=CD_2=1.17$ for CH_3, 1.09 for CF_3, $PhCD=CD_2=1.11$ for CH_3, 1.10 for CF_3, and $CD_2=CDCD=CD_2=1.20$ for CH_3, 1.09 for CF_3. It is concluded that the incipient CH_3 (or CF_3)–C bonds in the respective transition states are relatively long, and that the remaining groups around the reactive center retain their original planar configuration. (auth)

8160 EFFECT OF BOND ENERGY ON REACTIONS OF HOT HYDROGEN ATOMS AT C–H BONDS. Richard Wolfgang (Yale Univ., New Haven). J. Am. Chem. Soc., 84: 4586-8(Dec. 5, 1962).

Experimental data are presented that indicate that the effect of the energy of the C–H bond is unlikely to be of sufficient magnitude to be consistent with a previous proposal that variations are caused by a sensitive dependence of hot abstraction (but not substitution) on C–H bond energy. It is pointed out that the proposal admits of another explanation, which is independent of any effect of bond strength. It was previously assumed that the probability of abstraction per collision corresponded simply to the number of C–H bonds in the molecule struck. It was also implicitly assumed that the energy dependence for such reaction of recoil tritium was similar for methane and n-butane. It is felt that there is no a priori basis for such assumptions. Instead, the result could be expressed by simply stating that the ratio of total reaction cross sections of n-butane and methane, appropriately integrated over all energies, is significantly larger than the ratio of geometric collision cross sections. (P.C.H.)

8161 THE XENON RADIOSENSITIZED EXCHANGE OF DEUTERIUM ATOMS WITH METHANE. A. Maschke

and F. W. Lampe (Pennsylvania State Univ., University Park). J. Am. Chem. Soc., 84: 4601-2(Dec. 5, 1962).

Mixtures of Xe–D_2–CH_4 in the ratio 3:3:1 at a total pressure of 350 mm were irradiated. Evidence was obtained that indicated that $D + CH_4 \rightarrow HD + CH_3$ occurs at room temperature and above. The results were in accord with low values of E_1 and P_1 obtained by others with a previous estimate of $E_1 = 7.8$ kcal/mole and $P_1 \sim 10^{-3}$ to 10^{-4}, and were consistent with older values of E_1 of 11 to 13 kcal/mole found by the assumption that $P_1 = 0.1$. It was found that G'(HD) was nearly five times G'(CH_3D) and that ethanes (d_0-d_3) were formed in significant amounts, suggesting the presence of methyl and deuterated methyl radicals in the system. (P.C.H.)

8162 PHOTOCHEMICAL PREPARATION OF XENON DIFLUORIDE. James L. Weeks, Cedric L. Chernick, and Max S. Matheson (Argonne National Lab., Ill.). J. Am. Chem. Soc., 84: 4612-13(Dec. 5, 1962).

Xenon difluoride was prepared in relatively pure form by the photochemically induced reaction of xenon and fluorine at room temperature. Infrared spectra of the products of some irradiations showed an intense band with peaks at 549 and 565 cm^{-1} due to XeF_2 and showed no absorption at 590 cm^{-1} where XeF_4 has a strong absorption. XeF_2 is a solid at room temperature and easily forms crystals which can be made to sublime readily or to grow on a slightly cooled wall of a containing vessel. Room temperature powder patterns indicate that the cell is body-centered tetragonal with a = 4.316 and c = 6.993 kx. It appears to have a room temperature vapor pressure of about 2 mm. (P.C.H.)

8163 THE EFFECT OF CYCLO-OCTATETRAENE ON RADIATION-CHEMICAL REACTION. L. P. Ellinger (The British Oxygen Co. Ltd., London). J. Appl. Chem. (London), 12: 387-91(Sept. 1962).

Cyclo-octatetraene is shown to have a powerful retarding effect on several radiation-chemical reactions including the polymerization of vinyl acetate, vinylpyrrolidone, and styrene and the degradation of hydroxyethylcellulose in aqueous solution. (auth)

8164 QUENCHING AND ENERGY TRANSFER BY THE SAME SUBSTANCE. Milton Furst and Hartmut P. Kallmann (New York Univ., New York). J. Chem. Phys., 37: 2159-61(Nov. 15, 1962).

The quenching by o-terphenyl of the gamma-ray induced fluorescence of o-xylene/9,10-diphenylanthracene solutions does not give the usual linear dependence of I_0/I on quencher concentration. The effect is ascribed to a quencher concentration-dependent energy transfer from the solvent to o-terphenyl which has a finite transfer probability to the fluorescent solute. The interpretation was confirmed by the enhancement of energy transfer caused by the addition of o-terphenyl to a solution of a fluorescent solute in tri-n-butylphosphate, a solvent having a very low transfer efficiency. (auth)

8165 RADIATION-INDUCED FREE RADICALS IN SULFUR COMPOUNDS. ESR STUDIES IN THE POLYCRYSTALLINE STATE. Thormod Henriksen (Norsk Hydro's Inst. for Cancer Research, Oslo). J. Chem. Phys., 37: 2189-95(Nov. 15, 1962).

Secondary processes occurring in organic sulfur compounds, irradiated with ionizing radiation in the dry state, were followed by ESR spectroscopy. Samples were irradiated in vacuum at 77°K and the ESR spectra recorded at this temperature before and after stepwise heat treatment at successively increasing temperatures. The resonance spectra seem to indicate that after irradiation at 77°K, several kinds of ESR centers are formed. No or very few sulfur radicals seem to be formed at this temperature. The results show that few secondary processes proceed efficiently in solids in the temperature range from 77 to about 110°K. Depending upon the compound, decay processes seem to dominate in the temperature range varying from about 110°K and up to about 250°K. Upon further heat treatment, secondary reactions take place which lead to the formation of sulfur radicals. The threshold temperature for the reactions was about 170°K for simple thiols and disulfides, 240°K for peptides like glutathione, and about 280°K for proteins. The formation of sulfur radicals was found to coincide with an increase in the total number of observable ESR centers. Thus, in the case of penicillamine, the number of unpaired spins observed after annealing to 295°K exceeded the initial value at 77°K by about 70%. Evidence is presented that diffusion-controlled intermolecular reactions take place in irradiated solids, and it is suggested that the observed formation of sulfur radicals may in part be explained by such a mechanism. The resonance pattern due to polyoriented radicals of the type R–CH_2–S· (cysteine, cysteamine, glutathione, proteins) was found to exhibit a temperature dependent hyperfine splitting which is not found for radicals of the type R–CX_2–S· (penicillamine). (auth)

8166 ISOTOPE EFFECTS AND THE MECHANISM OF ATOM PRODUCTION IN GAMMA-IRRADIATED ICE AT 4.2°K. Henry S. Judeikis (Aerojet-General Corp., Azusa, Calif.), John M. Flournoy, and Seymour Siegel. J. Chem. Phys., 37: 2272-8(Nov. 15, 1962).

The relative intensities of the electron spin resonance (ESR) spectra of H and D atoms were determined for mixtures of H_2O and D_2O which were irradiated and observed at 4.2°K. A careful analysis of the results indicates that the yield of atoms per unit irradiation dosage exhibits no isotope effect, except for the system containing trace amounts of H_2O in D_2O. The presence of a large isotope effect for a system of D_2O containing approximately 0.1% H_2O is discussed in terms of energy transfer in the solid state. (auth)

8167 INFRARED SPECTROSCOPIC STUDY OF THE PHOTOLYSIS OF HN_3 IN SOLID CO_2. Dolphus E. Milligan (Mellon Inst., Pittsburgh), Marilyn E. Jacox, Stuart W. Charles, and George C. Pimentel. J. Chem. Phys., 37: 2302-10(Nov. 15, 1962).

Infrared studies were carried out on the photolysis of HN_3 and DN_3 in CO_2 matrices at 20 and 53°K. HNO and DNO were identified as products of the reaction of NH and ND with CO_2. The presence of HNO was confirmed by the detection of absorptions at 7400, 7100, and 6850 Å in the visible spectral region. Evidence was also obtained for the production of a 1:1 compound between NH (ND) and CO_2. Several possible structures for the species are discussed. (auth)

8168 ESR STUDY OF FREE RADICALS PRODUCED BY IRRADIATION IN BENZENE AND ITS DERIVATIVES. Shun-ichi Ohnishi, Tadayoshi Tanei, and Isamu Nitta (Japanese Assn. for Radiation Research on Polymers, Osaka). J. Chem. Phys., 37: 2402-7(Nov. 15, 1962).

Benzene and some of its mono- and di-substituted derivatives including toluene, chlorobenzene, benzoic acid, phenylcyclohexane, polystyrene, and xylenes were irradiated in their solid state at −196°C. After irradiation their ESR spectra were measured at that temperature and also up to their melting points. The spectrum of benzene consisted of two components. One was a main triplet (splitting 47.5 G) with a quartet substructure (splitting 10.4 G), each quartet showing further fine (probably triplet) splitting of

~2.5 G, and it was assigned to cyclohexadienyl radical C_6H_7·. When the temperature was raised the spectrum showed a marked narrowing from about −173°C where the C_6 reorientation of the benzene molecule sets in. At the same time the radical began to diminish and decayed out at −32°C, which is far below the melting point. The other component of the spectrum was a singlet of 25-G width at the maximum slope and was assigned to phenyl radical C_6H_5·. This component decayed out at 0°C. The spectra of the benzene derivatives were triplet, quite similar to that of benzene, and were interpreted to be due to the radicals produced as a result of hydrogen addition to the benzene ring. The G_R values determined at −196°C for benzene, cyclohexane, their 1:1 mixture, and phenylcyclohexane were 0.14, 5.04, 2.4, and 0.66, respectively. It is concluded that in the case of phenylcyclohexane some energy-transfer process may occur from the cyclohexyl ring to the phenyl ring. (auth)

8169 ESR STUDIES OF FREE RADICAL DECAY IN IRRADIATED POLYETHYLENE. Francis Cracco, A. J. Arvia, and Malcolm Dole (Northwestern Univ., Evanston, Ill.). J. Chem. Phys., 37: 2449-57(Nov. 15, 1962).

A study was made of the temperature and rates at which molecular hydrogen is evolved and free radical decay occurs when semicrystalline polyethylene, irradiated at liquid-nitrogen temperature, is warmed to room temperature. Hydrogen evolution and free radical decay roughly parallel each other. The temperature of half reaction is the same as the temperature of the gamma-maximum in the mechanical dispersion temperature curve. At constant temperature over the temperature range −71 to 41°C, the free radical decay is first order and the free radical concentration seems to decrease to a limiting value at each temperature. The first-order decay constants are approximately constant with temperature. The data are interpreted in terms of free radicals decaying in spurs. If a constant activation energy of 15 kcal $mole^{-1}$ is assumed, the frequency factors decrease with rise of temperature. This decrease is interpreted on the basis of a decreasing probability of reaction for those free radicals that escape reaction at low temperatures, but react at higher and higher temperatures. An alternative model, based upon the release of free radicals from traps as the temperature is raised, is also discussed. The reaction rate constant for free radical decay calculated from D−H exchange experiments agrees with that deduced from the ESR measurements. It is also concluded that the persistent free radical in polyethylene irradiated to moderate doses is the allyl free radical. (auth)

8170 CONVERSION OF SOLVATED ELECTRONS INTO HYDROGEN ATOMS IN THE PHOTO- AND RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS. Joshua Jortner, Michael Ottolenghi, Joseph Rabani, and Gabriel Stein (Hebrew Univ., Jerusalem). J. Chem. Phys., 37: 2488-95(Nov. 15, 1962).

Radiochemical and photochemical experiments that show that the conversion of solvated electrons to H atoms is not specific to the H_3O^+ ion are reported. Proton donors in general may react in the conversion $e^-_{aq} \rightarrow H$. The relative reaction rates correlate with the pK values of the acids as implied by Brønsted general acid catalysis law. The implications of the result for the nature of the solvated electron in water are briefly considered. (auth)

8171 CHEMISTRY OF POSITIVE IONS. II. ION-MOLECULE REACTIONS IN RADIOLYSIS OF n-HEXANE AT LOW TEMPERATURES. Larry Kevan and W. F. Libby (Univ. of California, Los Angeles). J. Chem. Phys., 37: 2496-7(Nov. 15, 1962).

n-Hexane was gamma irradiated at various temperatures. It was found that the yield of n-dodecane at room temperature was not affected by 0.03 M added iodine, or by 1% added pentene. Also, 8 mole % propylamine did not reduce the yield. The scavenger results at room temperature indicate that n-dodecane is formed by an ionic process involving the original ion radicals. An increase in yield showed that the process becomes more efficient at low temperatures. It is proposed that the product is formed by a hydrogen-atom abstraction reaction. (P.C.H.)

8172 EVIDENCE FOR ELECTRON BINDING IN FROZEN AQUEOUS SOLUTIONS. Joshua Jortner and Benjamin Sharf (Hebrew Univ., Jerusalem). J. Chem. Phys., 37: 2506-7(Nov. 15, 1962).

An investigation was made of electron binding in glasses prepared from frozen 10 N KOH−NaOH aqueous solutions at liquid-nitrogen temperature (77°K). Irradiation of glasses containing 5 N NaOH + 5 N KOH by 200 kv x rays led to the production of a broad absorption band at 350 mμ, with λ_{max} = 586 mμ. The absorption center was stable at 77°K, but heating to 160°K led to thermal annihilation. The 586 mμ band was assigned to an electron trapped in the glass. In order to yield further evidence for the identification of the band, attempts were made to produce trapped electrons in the NaOH−KOH glass by photoionization of glasses containing 10^{-2} to 10^{-3} M phenol. The absorption spectrum in the region 450−700 mμ, with λ_{max} = 586 mμ, produced by the photoionization of the phenolate ion was practically identical with the band obtained by x irradiation of the glass. (P.C.H.)

8173 ESR STUDIES OF γ-IRRADIATED n-OCTADECYL DISULFIDE. Frank K. Truby, Crawford MacCallum, and James E. Hesse (Sandia Corp., Albuquerque, N. Mex.). J. Chem. Phys., 37: 2777-82(Dec. 15, 1962). (TID-16445; SCDC-2749)

Octadecyl disulfide irradiated at −196°C in the absence of oxygen exhibits radicals reflecting breakage at the sulfur group to form RS· radicals as well as breakage in the alkyl group. During storage of the samples at from 0° to 40°C an increase in RS· concentration is observed while reduction of radicals in the alkyl group takes place. After initial rapid reactions occurring immediately after warm-up, a lower rate is observed for the increase in RS· content and decay of the radicals associated with the alkyl group. Both of these slower processes appear to occur as a result of a common reaction with an activation energy of about 13 kcal/mole. It is believed that this reaction involves the combination of a disulfide link with a radical in the alkyl group and occurs as a result of molecular diffusion in the crystalline material. Calculations based on a diffusion model yield theoretical curves which can be made to fit the experimental results within the limits of experimental error. (auth)

8174 PARAMAGNETIC RESONANCE STUDY OF PRODUCTION OF NO_2 AND NO_2^- IN IRRADIATED KNO_3. Henry Zeldes and Ralph Livingston (Oak Ridge National Lab., Tenn.). J. Chem. Phys., 37: 3017-18(Dec. 15, 1962).

Experiments were carried out on pure KNO_3 and KNO_3 containing $KN^{15}O_2$ impurity in order to study the relation between NO_2 and NO_2^- in irradiated KNO_3. The results show that NO_2^- is the source of NO_2 when KNO_3 with KNO_2 impurity is irradiated at 77°K, and when pure KNO_3 is irradiated twice with the temperature at room temperature during the first irradiation or between the two irradiations at 77°K. It is suggested that irradiation of pure KNO_3 at 77°K produces a precursor which gives NO_2^- on warning. (D.L.C.)

8175 EFFECTS OF γ-RADIATION. PART VI. ACTION OF γ-RADIATION ON DEAERATED SOLUTIONS OF ETHYLENE GLYCOL. S. A. Barker, J. C. Bevington, J. S.

Brimacombe, and E. D. M. Eades (Univ. of Birmingham, Eng.). J. Chem. Soc.: 4508-12(Nov. 1962).

The non-volatile products formed by γ-irradiation of ethylene glycol in 0.1% aqueous solution were determined quantitatively by isotope dilution analysis. The primary products are glycollaldehyde, erythritol, and threitol. Glycolic acid, glyoxylic acid, glyoxal, and oxalic acid are formed by secondary processes. The nature and quantities of the products indicate that dimerization of the HO · CH_2 · CH(OH) · radical initially produced is less favored than degradation involving species derived from the solvent. The overall degradation of ethylene glycol is small. (auth)

8176 PREPARATION OF TRITIOBUTANE BY THE REACTION OF TRITIATED WATER WITH n-BUTYLMAGNESIUM BROMIDE. R. Itô, N. Morikawa, and O. Simamura (Tokyo Univ.). J. Chem. Soc.: 4724-5(Nov. 1962).

It was found that water and excess butylmagnesium bromide in bis-2-ethoxyethyl ether produce two moles of butane per mole of water at 110°C in about two hours. The butane yield change with reaction time is tabulated. (P.C.H.)

8177 THE RELATIONSHIP BETWEEN RETENTION AND CHEMICAL CONSTITUTION. T. Costea and I. Dema (Inst. of Atomic Physics, Bucharest). J. Inorg. & Nucl. Chem., 24: 1021-2(Dec. 1962). (In English)

The radiocobalt retention (percentage of activity not extractable as Co^{2+}) was studied in the reactor irradiation of different crystalline cobaltic ammines, with the anion or ligand being varied. The retention values are tabulated; those for the halides show some regularity, but the others do not allow a relation between retention and chemical constitution to be deduced. (D.L.C.)

8178 ELECTRON SPIN RESONANCE OF GAMMA-IRRADIATED SINGLE CRYSTALS OF ACETYL-d,l-ALANINE AND CHLOROACETYL-d,l-ALANINE. Mikio Katayama (Duke Univ., Durham, N. C.). J. Mol. Spectry, 9: 429-35(Dec. 1962).

The electron spin resonance spectra of gamma-irradiated single crystals of acetyl-d,l-alanine and chloroacetyl-d,l-alanine were measured at 9 kMc/sec and 23.4 kMc/sec for various orientations in the external magnetic field. From the analysis of the hyperfine interaction constants, the free radical produced by gamma irradiation in both compounds was determined. The electron spin densities at the carbon atom attached to the methyl group were approximately 0.76 and 0.86 for acetyl-d,l-alanine and chloroacetyl-d,l-alanine, respectively. (auth)

8179 γ-RAY-INDUCED GRAFT COPOLYMERIZATION. II. THE COMPOSITION OF STYRENE GRAFTED POLYETHYLENE FILM. Tatsuo Matsuda. Kobunshi Kagaku, 18: 634-8(Oct. 1961).

Radioinduced grafted films contained a large quantity of the styrene homopolymer. The polystyrene homopolymer (A) could be separated by means of dissolution in hot xylene followed by cooling or by extraction with hot dioxane. It was found that the percentages of the grafted polystyrene to the total polystyrene in film were 25 and 35 in high and low pressure, respectively. Both grafted and occluded polystyrenes increased with increasing dosage at a near constant rate. The average molecular weight of the occluded (A) was about 5 times larger than the (A) produced in the liquid phase. (OID)

8180 γ-RAY INDUCED GRAFT COPOLYMERIZATION. III. THE SEPARATION OF POLYETHYLENE-STYRENE GRAFT COPOLYMER. Tatsuo Matsuda. Nagoya Kogyo Gijutsu Shikensjo Kokoku, 11: 182-8(Mar. 1962).

Powdered polyethylene (PE) prepared by the dissolution-precipitation procedure was grafted with styrene by γ irradiation from a 300-C Co^{60} facility at 7.4×10^4 r/hr at 25°C. Under the same conditions, the weights of the grafted polystyrene were always less than those of polyethylene film. The product contained very little occluded polystyrene homopolymer. The rate of grafting on low-pressure PE was also higher than the rate for high-pressure PE. The graft copolymer was separated from the reaction product by means of fractional precipitation using xylene-n-propyl alcohol and xylene-triethylene glycol, and the fractions were checked by turbidimetric titration and infrared absorption spectra. No free PE was observed. (OID)

8181 γ-RAY-INDUCED GRAFT COPOLYMERIZATION. IV. GRAFT COPOLYMERIZATION OF METHACRYLIC ACID TO POLYETHYLENE BY MUTUAL GRAFT TECHNIQUE. Tatsuo Matsuda. Kobunshi Kagaku, 19: 267-75(Apr. 1962).

Film samples were prepared by irradiating a polyethylene (PE) film immersed in a methanol solution of methacrylic acid by means of a 300- or 3000-C Co^{60} source. Results indicated that the initial grafting occurred mainly at the surface, which in turn served as the matrix for further grafting. The weight of the PE grafted increased almost linearly vs time. The increase in the grafting rate was due to the gel effect on the swollen film surface layer. The amount of polymethacrylic acid grafted in benzene-methanol system was greater than in methanol. The factors affecting the graft copolymers such as the film thickness, monomer concentration, dosage rate, solvent component, and the initial grafting rate are described. The electric surface resistance of the grafted film was also measured. (OID)

8182 γ-RAY-INDUCED GRAFT COPOLYMERIZATION. V. THE GRAFT COPOLYMERIZATION OF METHACRYLIC ACID TO POLYETHYLENE BY A PRE-IRRADIATION TECHNIQUE. Tatsuo Matsuda, Yoshiro Sakai, and Hiromi Yamakita. Kobunshi Kagaku, 19: 313-17 (May 1962).

Polyethylene (PE) film samples (0.07 mm thick, 1 × 10 cm in size) were irradiated by γ rays from a 470-C Co^{60} source at 6.7×10^4 r/hr on a 3000-C source at 3.2×10^4 r/hr in air. The effects of the induced graft copolymerization of the monomer to PE were investigated. Graft copolymerization could be initiated by both radicals and peroxides produced during the irradiation, and only by the latter if the irradiated PE was stored for a long time during which the trapped radicals gradually decayed. The degree of grafting induced by both radicals and peroxides was not proportional to the total dosage, but it was proportional when grafting was induced only by the peroxides. Hence, the degree of grafting induced in the former case was 4-5 times greater than the latter case within the irradiation temperature range of −78 to 0°C. It made very little difference when the temperature reached 40°C or above. The activation energy of the peroxide initiated grafting was 22 kcal/mol. The trapped radical was more stable in low rather than high pressure polyethylene. (OID)

8183 γ-RAY-INDUCED GRAFT COPOLYMERIZATION. VI. THE GRAFT COPOLYMERIZATION OF STYRENE ONTO CELLULOSE-ACETATE BY A PRE-IRRADIATION TECHNIQUE. Tatsuo Matsuda, Kiyoshi Hayakawa, and Kaoru Kawase. Kobunshi Kagaku, 19: 318-22(May 1962).

A 3000-C Co^{60} irradiation facility was used. The maximum degree of grafting was not affected by changing the storage condition of the irradiated fibers. It was increased slightly under the same dosage from −78 to 110°C. Hence,

grafting seemed to be initiated by the fairly stabilized peroxide formed in the irradiated fibers. It was observed that the maximum degree of grafting increased with irradiation dosage, while the rate of grafting decreased. This phenomena suggested that the peroxides were decomposed with further irradiation. The degree of grafting decreased with increasing temperature. The dependence of the grafting temperature on the total degree of grafting is discussed. The activation energy of peroxide decomposition was about 25 kcal/mol. (OID)

8184 ON THE QUESTION OF THE RADIOCHEMICAL LOW-TEMPERATURE POLYMERIZATION OF ACRYLENITRILE. Christel Schneider, Jakob Herz, and Dieter Hummel (Universität, Cologne). Makromol. Chem., No. 56, 228-33(1962). (In German)

The mechanism for low-temperature radioinduced polymerization of acrylonitrile was investigated. It was concluded that both radical and ionic mechanisms probably occur. (M.C.G.)

8185 THE ELECTRON SPIN RESONANCE SPECTRUM OF $HN(SO_3^-)$ IN γ-IRRADIATED POTASSIUM SULPHAMATE. J. R. Rowlands (National Physical Lab., Teddington, Middx., Eng.). Mol. Phys., 5: 565-71(Nov. 1962).

The electron spin resonance spectrum of the radical $NH(SO_3^-)$ trapped in a single crystal of potassium sulphamate is interpreted. The hyperfine couplings for the hydrogen and nitrogen nuclei are given. The radical is planar, the unpaired electron occupying an orbital of π symmetry being predominantly a nitrogen 2p orbital. (auth)

8186 THE STRUCTURE, ELECTRON RESONANCE AND OPTICAL SPECTRA OF TRAPPED CO_3^- AND NO_3. G. W. Chantry, A. Horsfield, J. R. Morton, and D. H. Whiffen (National Physical Lab., Teddington, Middx., Eng.). Mol. Phys., 5: 589-99(Nov. 1962).

Examination of irradiated potassium bicarbonate shows the crystal to contain trapped CO_3^- radicals, as well as $CO_2(H)$ radicals, and examination of irradiated urea nitrate shows this crystal to hold trapped NO_3 radicals. Electron resonance spectra and optical absorption spectra suggest that the radicals CO_3^- and NO_3 are planar, but do not possess a threefold axis. An examination of the expected wavefunction and energies discloses features which favor distortion of these radicals; these features are absent for CO_3^- and NO_3^-. (auth)

8187 ROLE OF OXYGEN IN THE PRIMARY FORMATION OF H AND H_3O^- IN THE RADIATION CHEMISTRY OF WATER. E. Hayon (Cambridge Univ., Eng.). Nature, 196: 533-4(Nov. 10, 1962).

Both H and H_3O^- can be formed directly in the radiolysis of oxygen-free water. In neutral solution $G_H = 0.55$ and $G_{H_3O^-} = 2.30$. In the presence of oxygen, all the reducing species formed ($G = 2.85$) are present as electrons. The independent formation of the two possible reducing species in neutral water, one capable of dehydrogenating (the acid form) and the other of reacting with electron acceptors (the alkaline form), provides further evidence that the main reducing species is H_3O^-. (L.T.W.)

8188 RADIATION-INDUCED SOLID-STATE POLYMERIZATION OF ACRYLONITRILE AND ACRYLAMIDE IN THE PRESENCE OF AN ELECTRIC FIELD. A. Charlesby, P. G. Garratt, and J. Morris (Royal Military Coll. of Science, Shrivenham, Eng.). Nature, 196: 574-5(Nov. 10, 1962).

The effect of high electric fields (~1 kv/cm) on the radioinduced solid-state polymerization of acrylonitrile is discussed. The results show that the electric field has little or no effect on the conversions of acrylonitrile. The charge separation thus cannot be a contributory factor in the electric field enhancement of the polymerization. Similar experiments were performed with acrylamide, this monomer being crystalline at room temperature. In the presence of an electric field there is no charge separation operative in the polymerization of acrylamide. (L.T.W.)

8189 γ-RAY-INDUCED FORMATION OF GOLD SOL FROM CHLOROAURIC ACID SOLUTION. Hitoshi Fujita, Masami Izawa, and Hideo Yamazaki (National Inst. of Radiological Sciences, Chiba City, Japan). Nature, 196: 666-7(Nov. 17, 1962).

When an aqueous solution of chloroauric acid was irradiated with γ rays, colloidal gold particles formed under the following conditions: initial concentration of chloroauric acid, 4.9×10^{-4} M; bubbling with oxygen; radiation dose rate of 9.3×10^3 r/min for 70 minutes. The particles formed had an average diameter of ~80 mμ. However, if a solution of the same concentration was exposed to a smaller total dose (0.89×10^5 r) in the same atmosphere, flat and thin hexagons or trigons were observed. (L.T.W.)

8190 GAMMA-RECOIL PRODUCTS FROM THE NEUTRON IRRADIATION OF COLLOIDAL SILVER. W. Parker (Chalmers Univ. of Tech., Göteborg). Nature, 196: 763-4(Nov. 24, 1962).

8191 ROLE OF ION-MOLECULE REACTIONS IN THE RADIOLYSIS OF HYDROCARBONS. R. Barker (Wantage Research Lab., Berks, Eng.). Nature, 196: 826-7(Dec. 1, 1962).

Calculations were made of the heat of the ion-molecule reactions of hydrocarbons up to a C_6 product ion. The general trend of these calculations indicates that while ion-molecular reactions are of importance for low molecular weight alkanes, they are less likely to occur with high molecular weight ones. (C.H.)

8192 OPTICAL-ROTATION DOSIMETRY FOR Co^{60} GAMMA FACILITIES. Alfred L. Glass (Naval Air Material Center, Philadelphia). Nucleonics, 20: 66; 68; 70(Dec. 1962).

When certain pure organic chemical compounds are exposed to gamma radiation, they rotate a beam of polarized light because of the asymmetric carbon atoms in their molecular structure. Since the amount of rotation depends on the intensity of the gamma radiation to which the compounds are exposed, changes in optical activity of the chemical solutions can give a measure of dose. Using this optical-rotation dosimetry theory, new dosimetry procedures for Co^{60} gamma facilities have been developed. (R.J.S.)

8193 MONOMERS IMPROVE RADIATION CROSS-LINKING IN POLYMERS. George Odian and Bruce S. Bernstein (Radiation Applications Inc., Long Island City, N. Y.). Nucleonics, 21: No. 1, 80-1(Jan. 1963).

Radiation cross-linking can result in a superior product or in deleterious effects. Incorporation of allyl methacrylate and allyl acrylate into polyethylene before Co^{60} irradiation gives a more heat resistant, higher tensile strength material. Promising results from introductions of monomers into polypropylene and polyisobutylene are also noted. (D.C.W.)

8194 THE RADIATION-CHEMICAL SULFOCHLORINATION OF POLYISOBUTYLENE. R. V. Dzhagatspanian, V. I. Zetkin, and V. S. Fechenko. Plasticheskie Massy, No. 5, 6-9(1962).

Since vulcanized chlorosulfonized polyethylene has good technical properties, a method was sought to improve the cheap, accessible, but technically imperfect polyisobutylene

by sulfochlorination. A solution of polyisobutylene in dry CCl_4 was sulfochlorinated in the K-1400 radiation unit by means of a Co^{60} radiation source (90 r/sec) according to the following reactions: $RH \rightarrow R^{\cdot} + H$; $R + SO_2 \rightarrow RSO_2^{\cdot}$; $RSO_2^{\cdot} + Cl_2 \rightarrow RSO_2Cl + Cl^{\cdot}$; $R^{\cdot} + Cl_2 \rightarrow RCl + Cl^{\cdot}$. The reaction with a mixture of SO_2 and Cl under the effect of γ rays set in immediately and proceeded at a high rate, limited only by the rate of heat dissipation, the efficiency of the supply, and the degree of mixing of the liquid and gaseous phases. The temperature and duration of the reaction, as well as the polyisobutylene concentration in the initial solution affected the reaction only slightly. Depending upon the Cl and S content, the reaction products were white substances varying from rubberlike to solid with good adhesion because of the presence of polar groups and atoms. Varnish films of sulfochlorinated polyisobutylene dried out without using an accelerator in 1.5–2.5 days. (OID)

8195 SUPEREXCITED STATES OF MOLECULES, AND THE PRIMARY ACTION OF IONIZING RADIATION. Robert L. Platzman (Argonne National Lab., Ill.). Vortex, 23: No. 8, 14p.(Oct. 1962). (TID-17143)

A review is presented of the processes taking place in radiation chemistry. The characteristics of ionizing-radiation action are outlined, and the temporal stages of radiation action are discussed. The number and nature of primary products in radiation chemistry are compared with those in photochemistry, and ionization efficiency and superexcited states are considered. (D.L.C.)

8196 PHOTOCHEMISTRY OF THE COMPLEX COMPOUNDS SOLUTIONS. Jerzy Szychlinski. Wiadomosci Chemi, 16: 607-24(1962). (In Polish)

A review is given on the photochemistry of complex compound solutions. Some interesting aspects are briefly discussed. (P.C.H.)

8197 INFLUENCE OF THE NEUTRON SPECTRUM ON RADIOLYTIC ENERGY IN ORGANIC LIQUIDS. Y. Droulers (Centre d'Études Nucléaires, Grenoble, France). IAEA Preprint SM-36/47. 20p. (In French)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A semi-experimental method was used to determine the spectral distribution of neutrons in the reflector of the Mélusine reactor. The integrals of energy release due to fast neutrons in the carbon, oxygen, and hydrogen were calculated. Up to 25 cm from the core these energy integrals are nearly proportional to the flux of neutrons with energies above 1 Mev. Thus, in order to determine the energy release in organic liquids due to neutrons, the flux corresponding to the true spectrum above 1 Mev must be measured. The cross sections needed for this measurement are given by threshold detectors (aluminum, sulfur, and nickel). The method was checked by a calorimetric test in water. (auth)

8198 INORGANIC ISOTOPIC SYNTHESES. Rolfe H. Herber, ed. New York, W. A. Benjamin, Inc., 1962. 252p.

Nine papers are presented as a guide to the preparation of isotopically labeled inorganic compounds. Authoritative methods are given along with numerous references to the literature. Separate abstracts were prepared for all the papers. (D.L.C.)

8199 GENERAL PROCEDURES. Seymour T. Zenchelsky (Rutgers State Univ., New Brunswick, N. J.). p.1-13 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

A review is presented on background information which should be useful in synthetic procedures for individual nuclides. The following items are treated: (1) handling of micro and millicurie amounts of radionuclides, (2) radiochemical manipulations, (3) radioassay, (4) assay for stable nuclides, and (5) terms and equations. (D.L.C.)

8200 INORGANIC DEUTERIUM COMPOUNDS. Henry L. Crepsi and Joseph J. Katz (Argonne National Lab., Ill.). p.14-53 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

Synthetic methods are given for preparing inorganic compounds in which hydrogen is fully replaced by deuterium. The compounds include deuterides, deutero-oxides, acids, acid salts, and hydrates. (D.L.C.)

8201 SYNTHESES WITH TRITIUM. F. S. Rowland (Univ. of Kansas, Lawrence). p.54-73 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

The nuclear properties, natural occurrence, and artificial production of tritium are discussed briefly. Methods of counting tritium are described. Tritium exchange and isotope effects in reactions are considered. Synthetic methods for specific inorganic tritium compounds are described. (D.L.C.)

8202 NITROGEN-15. W. Spindel (Rutgers State Univ., Newark, N. J.). p.74-118 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

A general literature survey of nitrogen-15 is presented. The properties of nitrogen isotopes and the occurrence of nitrogen-15 are discussed briefly. Methods of nitrogen-15 concentration and analysis are given. A review is given of the synthesis of nitrogen-15-labeled inorganic compounds. (D.L.C.)

8203 OXYGEN-18. I. Dostrovsky and D. Samuel (Weizmann Inst. of Science, Rehovoth, Israel). p.119-42 of "Inorganic Isotopic Synthesis." New York, W. A. Benjamin, Inc., 1962.

A review is presented of methods for analysis and synthesis of inorganic compounds labeled with oxygen-18. (D.L.C.)

8204 RADIOPHOSPHORUS. L. Lindner (Institut voor Kernphysisch Onderzoek, Amsterdam). p.143-92 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

The nuclear properties of P^{32} and P^{33} are described briefly. Methods are given for counting and producing P^{32} and P^{33}. Synthetic procedures are given for inorganic P^{32} compounds. (D.L.C.)

8205 SULFUR-35. Rolfe H. Herber (Rutgers State Univ., New Brunswick, N. J.). p.193-214 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

The nuclear properties of S^{31}, S^{35}, S^{37}, and S^{38} are described briefly. Radioassay of S^{35} is discussed. A review of synthetic methods is given for sulfur-35 compounds. (D.L.C.)

8206 RADIOCHLORINE. B. J. Masters (Los Alamos Scientific Lab., N. Mex.). p.215-26 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

The nuclear properties of some chlorine isotopes are described briefly. A survey of synthetic methods is presented for compounds of chlorine-36 in the −1 and higher oxidation states. (D.L.C.)

8207 IODINE-131. Milton Kahn (Univ. of New Mexico, Albuquerque). p.227-42 of "Inorganic Isotopic Syntheses." New York, W. A. Benjamin, Inc., 1962.

The detection and production of iodine-131 are discussed.

The chemical behavior of iodine-131 in tracer concentrations is described briefly. Preparations of aqueous solutions of carrier-free iodine-131 compounds and macro amounts of iodine-131-labeled compounds are discussed for the various oxidation states. (D.L.C.)

8208 AN INVESTIGATION OF THE RADIATION EFFECTS IN POTASSIUM AZIDE BY ELECTRON SPIN RESONANCE. Douglas Wilson Wylie. Thesis, Storrs, Conn., Univ. of Connecticut, 1962. 88p.

Electron spin resonances were detected when single crystals of potassium azide (KN_3) were irradiated at 77°K with ultraviolet light and gamma rays. At least three defects were produced when the crystals received 10^6 r of gamma rays. One was identified as trapped nitrogen atoms, while the other two were tentatively identified as N_2^- molecule-ions and N_4^- molecule-ions. The latter is the same defect as first detected when KN_3 was irradiated at room temperature. The trapped nitrogen atoms have effective spin $S = 3/2$, and each fine structure component shows the hyperfine pattern of a single N^{14} nucleus. The nitrogen atoms are trapped in an 001 plane, in two magnetic sites, which are equivalent for a 90° rotation about the 001 axis. Sites, which would exhibit the proper symmetry, are interstitial positions between two potassium ions. Choosing z parallel to [110], x parallel to [1$\bar{1}$0] and y parallel to [001], the results were fitted to the spin-Hamiltonian $H = |\beta| \vec{H} \cdot g \cdot \vec{S} + D [S_z^2 - 1/3 S (S + 1)] + E (S_x^2 - S_y^2)$ where $g = 2.0014 \pm 0.0008$, $D = 0.0143 \pm 0.0001$ cm^{-1} and $E = -0.00199 \pm 0.00001$ cm^{-1}. The hyperfine interaction is $A = 0.00051 \pm 0.00002$ cm^{-1}. The spectrum characteristic of the nitrogen atoms bleaches upon irradiation at 77°K with ultraviolet light, and anneals at approximately 150°K. The molecule-ion described at N_2^- exhibits a five-line spectrum with intensity ratios 1, 2, 3, 2, 1. This is characteristic of a single unpaired electron interacting with two equivalent nitrogen nuclei. They are located in two equally populated magnetic sites in an 001 plane, which are equivalent for a rotation of 90° about the 001 axis. For the same choice of axes the measured values of the g tensor are: $g_x = 1.984 \pm 0.001$, $g_y = 2.001 \pm 0.001$, $g_z = 1.984 \pm 0.001$. The hyperfine interaction is: $A_x = 4.0 \pm 0.2$, $A_y = 4.0 \pm 0.2$, $A_z = 6.0 \pm 2$. As the N_2^- molecule-ion anneals, the intensity of the N_4^- molecule-ion increases reaching a maximum when the N_2^- molecule-ion has disappeared. The N_2^- molecule-ions are produced either by ultraviolet light or by Co^{60} gamma rays. Trapped nitrogen atoms were also detected when sodium azide was irradiated at 77°K with 10^6 r of Co^{60} gamma rays. (Dissertation Abstr., 23: No. 5, Nov. 1962)

8209 METODY POLUCHENIYA RADIOAKTIVNYKH PREPARATOV. (Preparation of Radioactive Elements). N. E. Brezhnevoi, ed. Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962. 172p.

Seventeen articles are included on preparing and measuring radioactive organic and inorganic compounds. Articles are devoted to the preparation of labeled vitamin B_6, vitamin B_{12}, and various iodine compounds. Articles are also included on the solvent extraction of Mg^{28} and Y^{90} and the chromotographic preparation of carrier-free Pm^{149}. Separate abstracts have been prepared for four articles. (R.V.J.)

8210 PREPARATION OF TRITIUM LABELED ORGANIC COMPOUNDS BY MEANS OF ATOM RECOIL. V. V. Pozdeev, A. N. Nesmeyanov, and B. G. Dzantiev. p.89-93 of "Metody Polucheniya Radioaktivnykh Preparatov." Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962.

Effects of irradiation time, admixtures, and phase state on the recoil preparation of tritium labeled compound were investigated using cyclic hydrocarbons (benzene, cyclohexadiene, cyclohexene, and cyclohexane) and tritium recoils from Li_6 (n,α) reactions. (R.V.J.)

8211 PREPARATION OF RADIOCHEMICALLY PURE CARRIER-FREE Y^{90}. A. G. Nazin, V. I. Levin, and M. M. Golutvina. p.118-23 of "Metody Polucheniya Radioaktivnykh Preparatov." Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962.

A solvent extraction of carrier and Sr^{90} free Y^{90} from 12n nitric acid was achieved with tributyl phosphate. Forty μC of 99.999% Y^{90} was separated with a yield of ~97%. (R.V.J.)

8212 PREPARATION OF CARRIER-FREE Pm^{149}. I. N. Tronova, E. A. Tikhomirova, and K. N. Shlyagin. p.147-60 of "Metody Polucheniya Radioaktivnykh Preparatov." Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962.

Chromatographic partition of Nd^{147} and carrier-free Pm^{149} from irradiated neodymium oxide is described. The radiochemical purity and activity of prepared materials are analyzed. (R.V.J.)

8213 PREPARATION OF CARRIER-FREE Cu^{64}, Sb^{125} AND Ac^{228} BY MEANS OF INTERNAL ELECTROLYSIS. B. Z. Iofa, G. M. Dakar, and N. M. Kilesnikova. p.161-9 of "Metody Polucheniya Radioaktivnykh Preparatov." Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962.

Internal electrolysis was used to obtain an 80% yield of carrier-free Cu^{64} from irradiated zinc and 100% yield of Sb^{125} from irradiated tin. A method was also developed for Ac^{228} partition from Ra^{228} by internal electrolysis. (R.V.J.)

8214 THE RADIATION-INDUCED REACTION BETWEEN CARBON MONOXIDE AND WATER. Rolf Steinmann. Thesis, Hoboken, N. J., Stevens Inst. of Tech., 1962. 108p.

The radiation-induced reaction between carbon monoxide and water vapor was studied in the presence and absence of foreign gases. The products obtained were carbon dioxide and hydrogen. It is shown that the reaction mechanism is essentially that obtained in the thermally-induced reaction. Reaction rate constants calculated on the basis of the equation $(d/dt)(CO_2) = k(H_2O)(CO)^{\frac{1}{2}}$ were constant and indicated that the products formed were from free radical reactions and not ion-molecule reactions. The ratio of the yield of carbon dioxide to hydrogen approached unit as the partial pressures in the reaction mixture of carbon monoxide to water vapor approached unity. (Dissertation Abstr., 23: No. 5, Nov. 1962)

8215 COMPOSITION AND PROCESS ADAPTED TO IMPROVE THE RESISTANCE TO DETERIORATION OF POLYAROMATIC HYDROCARBONS AT HIGH TEMPERATURE AND UNDER THE INFLUENCE OF NUCLEAR IRRADIATION. (to United States Atomic Energy Commission). French Patent 1,264,729. May 15, 1961. Priority date July 21, 1959, United States.

A composition of improved resistance to deterioration at an elevated temperature and under the influence of nuclear irradiation comprises essentially a polynuclear aromatic composition especially polyphenyls having nonfused nuclei, and 1 to 10%, especially 2 to 8%, phenazine. This addition of phenazine improves the resistance to deterioration of the aromatic hydrocarbon which suitably is constituted of diphenyl, m-terphenyl, o-terphenyl, or quaterphenyls. (IIB)

8216 ALKYLATION PROCESS. John Handschy, Robert J. Gordon, and Robert J. Moore (to Shell Oil Co.). U. S. Patent 3,050,453. Aug. 21, 1962.

A process for producing alkyl aromatic hydrocarbons comprises exposing a liquid mixture of an alkyl naphthalene and a saturated aliphatic hydrocarbon to gamma radiation. (R.J.S.)

8217 REACTION OF OLEFINS BY RADIATION. Henry G. Schutze and Andrew D. Suttle, Jr. (to Esso Research and Engineering Co.). U. S. Patent 3,071,524. Jan. 1, 1963. Filed Apr. 1, 1957.

A hydrocarbon is converted by forming a gaseous mixture of an olefin and a nitrogen compound such as ammonia. The mixture is exposed to ionizing radiation for a sufficient length of time to form a product. (R.J.S.)

8218 HYDROCARBON RADIOCHEMICAL CONVERSION PROCESS. Peter J. Lucchesi, Chester L. Read, and Robert B. Long (to Esso Research and Engineering Co.). U. S. Patent 3,072,548. Jan. 8, 1963. Filed Aug. 1, 1956.

A hydrocarbon radiochemical conversion process is described for polymerizing aliphatic hydrocarbons having from 2 to 20 carbon atoms per molecule. Saturated aliphatic hydrocarbons are exposed to radiation, preferably neutrons and gamma rays. (R.J.S.)

Raw Materials and Feed Materials

Refer also to abstract 8718.

8219 (MCW-1479) PROCESS DEVELOPMENT QUARTERLY PROGRESS REPORT, JULY–SEPTEMBER 1962. (Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.). Nov. 1, 1962. Contract W-14-108-eng-8. 41p.

Maximum anode current densities were measured for uranium electrolytic cells as a function of UF_4 concentration in the electrolyte. The effects of dissolved UO_2 on the maximum anode current densities were also observed. Two systems for tapping liquid uranium from an electrolytic cell were developed on a small scale. Both techniques, one a stopper-rod and weir system and the other a vacuum withdrawal system, are suitable for further testing on a larger scale. Instrumentation was developed for the spectrographic analysis of micro-areas of metallographically prepared samples by a direct-sparking technique. A feature of the system is the use of the spark plasma envelope as the effective entrance slit of the spectrograph. Selected areas 10 microns in diameter can be resolved from adjacent areas. The system is being used in the investigation of phase relationships in uranium alloys and in the study of uranium-aluminum bonding. (auth)

8220 (TID-17519) GEOLOGIC ASPECTS OF THORIUM RECOVERY FROM COMMON ROCKS. Quarterly Progress Report, September 1, 1962–November 30, 1962. John A. S. Adams and John J. W. Rogers (Rice Univ., Houston, Tex.). For Oak Ridge National Lab., Tenn. Contract [W-7405-eng-20], Subcontract 1491. 7p.

The analysis of Conway granite for thorium is reported and the results are presented. (R.J.S.)

8221 (VDIT-67) THE PRODUCTION OF URANIUM HEXAFLUORIDE. A Literature Survey. M. Seleborg (Aktiebolaget Atomenergi, Stockholm). Dec. 1962. 35p.

This survey comprises 105 abstracts arranged in chronological order. Sources employed in the survey include Nuclear Science Abstracts, 1955–1961 and January–October 1962, and Chemical Abstracts, 1955–1960. (L.T.W.)

8222 FRANCE'S URANIUM ORE CONCENTRATION PLANTS. Comit. Naz. Energia Nucl., Notiziario, 8: No. 6, 80-5(June 1962). (RT/GEO(62)7). (In Italian)

France's uranium industry, which began as recently as 1955, is growing at an exceptionally fast rate. France is now the fourth among western countries in U production, after United States, Canada, and South Africa. Total productive capacity of French establishments in Gueugnon, l'Escarpière, Bessines, Forez, and Mounana is of about 2,000 tons yearly. Uranium ore concentration plants and processes adopted are described. (auth)

8223 POLYMERIC LIGANDS. SEPARATION OF URANIUM FROM SOLUTIONS AND ORE LEACHES WITH SALICYLIC ACID-FORMALDEHYDE POLYMERS. R. C. Degeiso, L. G. Donaruma, and E. A. Tomic (E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.). Ind. Eng. Chem., Process Design Develop., 2: 43-4(Jan. 1963).

Uranium is extracted as uranyl ion from solutions, using salicylic acid-formaldehyde polymers. Use of the technique described gave uranium of good purity in high yields. (auth)

8224 SEPARATING AND REFINING Th BY MEANS OF SALICYLIC ACID. A. V. Nikolaev, Z. G. Rumyantseva, and B. V. Levin (Inst. of Inorganic Chemistry, Academy of Sciences, Siberian SSR). Izv. Sibirak. Otd. Akad. Nauk SSSR, No. 9, 39-45(1962). (In Russian)

A satisfactory solvent extraction of Th by salicylic acid was achieved in the presence of various admixtures (Al, Ca, Mg, Mn, Pb, Ni, Cu, and Cr) with only trivalent iron hindering the recovery. A satisfactory quantitative precipitation of Th was accomplished in the presence of uranium without capturing the latter. Salicylic acid separation of Th and La resulted in final precipitation at pH 3.8. The solubilities of thorium salicylate in ether in the presence of various amounts of salicylic acid were determined, and separation of U and Th by ether extraction of thorium salicylate was demonstrated. Solvent extraction of Th by aceton and separation of mesathorium I and II and La from U resulted in pure Th-232. (R.V.J.)

8225 THE PREPARATION OF URANIUM TETRAFLUORIDE BY WET METHODS. H. Liebscher and C. Fischer (Institut für Angewandte Physik der Reinststoffe, Dresden). Kernenergie, 5: 616-17(Aug. 1962). (In German)

A method for the preparation of UF_4 by wet procedures on a laboratory scale is described. UO_2Cl_2 was continuously reduced in an electrolytic cell to UCl_4. The UCl_4 was also continuously converted in a precipitation apparatus to $UF_4 \cdot xH_2O$ with hydrofluoric acid at 70 to 90°C. The dehydration to water-free UF_4 was done in a vacuum at 500°C. The apparatus and reaction conditions are illustrated. (tr-auth)

8226 ON THE SEPARATION AND PURIFICATION OF THORIUM BY AMEX PROCESS. Kazutaka Kawamura and Takeji Takeuchi (National Research Inst. for Metals, [Tokyo]. Nippon Genshiryoku Gakkaishi, 4: 774-80(Nov. 1962). (In Japanese)

The amine extraction (Amex) process can be used effectively for the extraction and separation of thorium from monazite liquor in which rare earths coexist about 10 times richer than thorium. The results of batch tests on extraction of thorium with 0.18M Primene JM-T as a solvent show that nuclear grade thorium can be produced by a proper choice of scrubbing solution if desired. When 4 stages of scrubbing with 0.014M nitric acid solution are used, the content of rare earths in thorium decreases to less than 12 ppm. (auth)

8227 INVESTIGATION ON THE OBTAINING OF URANIUM FROM THE URANIUM ORE. S. Domanus, J. Panas, Z. Grzybowski, and K. Czarnomska (Inst. of Nuclear Re-

search, Polish Academy of Sciences, Warsaw). Nukleonika, 7: 487-93(1962). (In Polish)

The parameters of the process of sulfuric-acid leaching of Polish uranium ore were investigated. Tests were made in laboratory to determine optimum conditions of processing. It was found that the highest output (97 to 98% U) was obtained by using 70 g H_2SO_4 and 10 g MnO_2 for 1 kg of uranium ore, while leaching for 6 hours in ambient temperature. Experiments on a pilot-plant scale confirmed the results obtained in laboratory experiments with regard to the output of leaching. (auth)

8228 STUDIES ON THE NEUTRALIZATION OF WASTES FORMING AS THE RESULT OF THE SULFURIC ACID TREATMENT ON URANIUM ORES. Rafal Wlodarski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika, 7: 495-7(1962). (In Polish)

Wastes obtained as a result of treatment of uranium ores by 10% sulfuric acid were extracted with amine solution. They were then treated by lime milk and barium carbonate to neutralize and precipitate radium together with other products of uranium decay. The clear solution obtained was evaporated to dryness and the α activity of the sediment was measured. The measures showed lowering of α activity by about two orders. Finally the solutions contained about 6×10^{-7} μC/ml of α activity and 10^{-7} μC/ml of β activity. Gamma activity was not detected. (auth)

8229 METHOD OF DEHYDRATING URANIUM TETRAFLUORIDE. J. O. Davis, C. C. Fogel, and W. E. Palmer (to U. S. Atomic Energy Commission). U. S. Patent 3,069,228. Dec. 18, 1962.

Drying and dehydration of aqueous-precipitated uranium tetrafluoride are described. The UF_4 which normally contains 3 to 4% water, is dispersed into the reaction zone of an operating reactor wherein uranium hexafluoride is being reduced to UF_4 with hydrogen. The water-containing UF_4 is dried and blended with the UF_4 produced in the reactor without interfering with the reduction reaction. (AEC)

8230 PROCESS OF PREPARING DOUBLE FLUORIDE OF TETRAVALENT URANIUM AND ALKALINE EARTH METAL. Pierre Pagny and Petros Koussouros (to Potasse et Engrais Chimiques). U. S. Patent 3,073,671. Jan. 15, 1963. Priority date Jan. 2, 1958, France.

A method is outlined for preparing a double fluoride of uranium(IV) and Ca or Mg. The method comprises reacting at 100°C a solution of a Ca or Mg salt (chloride, nitrate, or sulfate) with a double fluoride of uranium(IV) and an alkali metal to precipitate the desired double fluoride. The reaction is $UF_4 \cdot nMF + 0.5n\ M'^{2+} \rightarrow UF_4 \cdot 0.5nM'F_2 + n\ M^+$, where M^+ = an alkali metal or ammonium cation, and M'^{2+} = Ca or Mg cation. Several examples are given for the preparation of such double fluorides and their use in the manufacture of metallic uranium. (D.L.C.)

Separation Processes

Refer also to abstract 8248.

8231 (BM-RI-6131) HYDROGEN AS A RETAINING ION FOR RARE-EARTH SEPARATION BY ION EXCHANGE WITH EDTA AND DCTA. R. E. Lindstrom and J. O. Winget (Bureau of Mines. Reno Metallurgical Research Center, Nev.). Dec. 1961. 21p.

Effective separation of rare-earth mixtures was obtained using hydrogen as a retaining ion at 200°F with ethylenediaminetetraacetic acid (EDTA) eluant. Results obtained in Bureau of Mines bench-scale apparatus and large columns with hydrogen as a retaining ion closely parallel those obtained with copper as a retaining ion. The use of hydrogen as a retaining ion permits EDTA and water, collected before rare-earth breakthrough, to be recovered in a form that allows the material to be recycled without extensive processing. With the exception of yttrium and dysprosium, separation of rare-earth mixtures was improved and throughput is increased by elevated temperatures. Separation with 1,2-diaminocyclohexanetetraacetic acid (DCTA) eluant increased markedly on increasing temperature from ambient to 250°F; however on the basis of separation efficiency, DCTA does not compare favorably with EDTA. (auth)

8232 (BNL-5479) THE ROLE OF FUEL REPROCESSING IN THE ECONOMICS OF ATOMIC POWER. Bernard Manowitz (Brookhaven National Lab., Upton, N. Y.). May 1961. Contract AT-30-2-GEN-16. 33p.

Different types of fuel reprocessing plants are described, and the costs of operating these plants at three different scales are estimated. The factors which limit the throughput of the plants are considered and analyzed for four different types of fuel. Estimates are given for the cost of reprocessing these fuels in the various types of plants considered. (M.C.G.)

8233 (BNL-6039) REPROCESSING REACTOR FUELS IN INERT FLUIDIZED BEDS. E. Wirsing, Jr., J. J. Reilly, and L. P. Hatch (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 6p.

A fluidized bed of inert material offers an efficient heat transfer medium for carrying out volatility reprocessing of fuels in the solid state, and a variety of fuel element types can be reprocessed in the same equipment. Studies were carried out on the best conditions for the reprocessing of various fuel materials in fluidized beds of blocky type abrasive grain alumina in nickel reactors. Uranium coupons were readily fluorinated at $\leq$475°C, and uranium is best recovered by fluidized operation with 25% F_2 at 450°C. Hydrochlorination of Zircaloy was satisfactory at 450°C. The optimum bed particle size is ~60 mesh. Carbide fuels should first be oxidized with 2:1 O_2–NO_2 mixtures to give U_3O_8 which can then be fluorinated. UO_2 also should be oxidized to U_3O_8 prior to fluorination. Stainless steel cladding can be removed by Cl_2 at 700 to 750°C, but the bed should be in the static condition to prevent attack of the nickel reactor walls. Graphite should be oxidized to CO_2 at 700 to 750°C. (D.L.C.)

8234 (BNL-6141) SYNERGISTIC EFFECT OF TRI-N-OCTYLAMINE ON THE SOLVENT EXTRACTION OF THORIUM BY THENOYLTRIFLUOROACETONE. Leonard Newman and Paul Klotz (Brookhaven National Lab., Upton, N. Y.). Apr. 26, 1962. Contract [AT 30-2 -Gen-16]. 23p.

The synergistic effect of tri-n-octylamine (R_3N) on the solvent extraction of thorium by thenoyltrifluoroacetone (HT) has been shown to arise from the organic-phase reaction $ThT_4 + R_3NHCl = ThT_4R_3NHCl$, where R_3NHCl represents the amine hydrochloride and T^- the enolate ion of HT. The formation constant for this reaction was measured in benzene as $(2.6 \pm 0.4) \times 10^3$. It has been demonstrated that the amine species $R_3NHClHT$ and R_3NHT do not give rise to a synergistic effect. It is concluded that the amine hydrochloride is attached to one of the trifluoroacetone molecules on the thorium and not to the thorium itself. The synergistic effect was studied over the ranges of HT from 0.05 M to 0.2 M, thorium from 1.0×10^{-4} M to 25×10^{-4} M, H^+ from 0.1 M to 0.5 M, and Cl^- at 0.1 M and 2.0 M. (auth)

8235 (DP-811) PROCESSING OF POWER REACTOR FUELS. Quarterly Progress Report No. 20, July 1–

October 1, 1962. J. Harding Owen, comp. (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Dec. 1962. Contract AT(07-2)-1. 14p.

Cermet fuel assemblies of the APPR type were successfully dissolved in the semiworks electrolytic dissolver; a nonconducting basket of NEMA Grade G-7 plastic held the fuel during dissolution. Stray-current corrosion of the stainless steel dissolver vessel was eliminated by shielding the anode from the vessel. Recent semiworks tests suggest that some sodium-bonded power fuels might be dissolved safely in nitric acid in an electrolytic dissolver; the sodium was gradually exposed to the acid when a fuel rod was slowly lowered into an electrolytically active region at a temperature low enough (40 to 45°C) to prevent the sodium from flowing from the rod. (auth)

8236 (HW-59983) REMOVAL AND RECOVERY OF PLUTONIUM FROM RECUPLEX PROCESS WASTE BY ANION EXCHANGE. A. E. Reisenauer and J. L. Nelson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 10, 1959. Contract W-31-109-eng-52 and AT(45-1)-1350. 17p.

A summary of results obtained in an investigation of the variables associated with the design and operation of a prototype exchange column for the Recuplex process waste stream is presented. Operating conditions included a temperature of 25°C, a flow rate of 3.5 ml/cm^2/min, and a column length of 50 cm. Under these conditions, column volumes processed to 5% breakthrough were 15, 90, and 215 for Permutit SK, Amberlite IRA 401, and Amberlite IRA 400, respectively. (J.R.D.)

8237 (HW-74210) THE ELECTROSTATIC BUBBLE SCRUBBER. R. T. Allemann and U. L. Upson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 9, 1962. Contract AT(45-1)-1350. 13p.

An electrostatic precipitator was developed, which achieves high efficiency (99 to 99.9%) at reasonably low pressure drop (1 to 2 in. of water). Its effectiveness is obtained by bubbling gas laden with electrostatically charged particles through a liquid of opposite charge. The dust-laden gas stream is passed through a corona discharge region which imparts an electrical charge to each particle, and then is quickly bubbled through a conducting liquid at ground potential. Particle loading in the gas leaving the scrubber was an exponential function of applied voltage and was inversely proportional to residence time. (M.C.G.)

8238 (HW-75296) EFFECT OF HEAT TREATMENT ON CLINOPTILOLITE. K. C. Knoll (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 19, 1962. Contract AT(45-1)-1350. 7p.

The selectivity of clinoptilolite for trace cesium in a sodium solution was nearly doubled by heating the mineral to 400°C for at least two hours. The total exchange capacity is not affected. The elution of the cesium from the clinoptilolite was not impaired by this treatment. Samples of clinoptilolite from California, Nevada, and Oregon were used in this study. One sample from the Nevada site did not respond to heat treatment. (auth)

8239 (HW-75309) ANION EXCHANGE RECOVERY OF PLUTONIUM FROM THE HANFORD 234-5 BUILDING BUTTON LINE. TASK I OXALATE FILTRATE. E. J. Wheelwright (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 13, 1962. Contract AT(45-1)-1350. 16p.

Results of a laboratory investigation undertaken to adapt the Pu anion exchange process to the direct recovery of the Pu lost to the Task I oxalate filtrate are reported. It was found that the Button Line Task I Filtrate can be recovered by HNO_3 anion exchange process, thus isolating the Button Line from any solvent extraction process. (J.R.D.)

8240 (HW-SA-2364) CHARACTERIZATION OF A STRONTIUM-SELECTIVE ZEOLITE. L. L. Ames, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 20, 1961. Contract AT(45-1)-1350. 15p.

A group of several zeolites, including Type A, clinoptilolite, erionite, phillipsite, and alumina-silica gel, was examined for the ability to selectively remove small amounts of strontium from aqueous wastes containing high concentrations of sodium salts. The methods used and the zeolite strontium selectivity data from this study are reported. Type A zeolite was the most selective of the group for strontium, but more than a simple, reversible exchange reaction was responsible for this strontium selectivity. (auth)

8241 (HW-SA-2396) SOLVENT EXTRACTION RECOVERY AND PURIFICATION OF STRONTIUM-90. Wallace W. Schulz, John E. Mendel, and Gerald L. Richardson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 13, 1961. Contract [AT (45-1)-1350]. 33p.

A solvent extraction process was developed to produce high-purity Sr^{90} from an irradiated U reprocessing waste solution. The extractant is D2EHPA diluted with TBP and Shell Spray Base. The process uses an acetic acid-acetate buffered aqueous phase which is countercurrently contracted with the D2EHPA organic phase. Calcium and some Ce^{144} extract with the Sr^{90}; extraction of other contaminants (Zr^{95}, Nb^{95}, Ru^{106}, and inert lead and iron) is prevented by adding either DTPA or EDTA to the feed solution. Decontamination from Ca and Ce^{144} is provided by back extraction of the Sr^{90} into an aqueous 1M citric acid solution. The process was used to isolate and purify about one megacurie of Sr^{90} for subsequent use in the fabrication of thermoelectric power generators as part of the Systems for Nuclear Auxiliary Power (SNAP) program. (auth)

8242 (IDO-14594) AN IMPROVED AQUEOUS PROCESS FOR ZIRCONIUM ALLOY NUCLEAR REACTOR FUELS. PART I. PRELIMINARY LABORATORY STUDIES. K. L. Rohde, B. J. Newby, B. E. Paige, A. P. Roeh, T. L. Hoffman, and L. A. Decker (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Oct. 30, 1962. Contract AT(10-1)-205. 46p.

The expanding use of Zircaloy-clad Zr-enriched U alloy fuel suggested a need for higher capacity reprocessing facilities. The most urgent requirement is for continuous dissolution equipment to match the solvent extraction capacity already available at Idaho Chemical Processing Plant. Because of the rapid dissolution rates possible with aqueous HF on clean metal as well as on oxidized fuels, and subsequent flowsheet economics, it is the reagent of choice. Laboratory measurements and a survey of the properties of UF_4 indicated highest solubility in the dissolver effluent was obtained at higher total fluoride concentrations and lower fluoride-to-Zr mole ratios. Since Zr salts were shown to be susceptible to precipitation at higher fluoride and Zr concentrations, an optimum dissolver effluent composition was selected for a Dilute Flowsheet at about 5M total fluoride and a 1.1M Zr. The operation of two bench-scale dissolvers verified the feasibility of a continuous process, and Monel and Carpenter-

20(Nb) were confirmed as suitable materials of construction for the dissolver. Using the Dilute Flowsheet, U solubility equivalent to the dissolution of fuels containing 2% U, overall, was achieved. Correlations of dissolver effluent flow rate with effluent composition and with total Zr dissolved are given for guidance in engineering scale-up. (auth)

8243 (JAERI-1038) DEIONIZATION PROCESSES WITH ION EXCHANGE AND WITH ELECTROMIGRATION. Junichi Shimokawa (Japan Atomic Energy Research Inst., Tokyo). 1962. 90p.

Studies were undertaken to gain understanding of the kinetics of the ion exchange and ion-exchange-electrolysis operation. Equations and data were obtained on cation and anion exchanges in the fixed-bed equipment. Methods of separating the contributions of liquid- and solid-side diffusional resistances and of calculating the height of the exchange zone within the fixed bed and the resin-utilization factor are discussed. Based on the experiments, the Sherwood number was found to vary with the 0.78 to 0.80 power of the Reynolds number. Two analytical methods, the modified Maxwell-Eucken's model and octahedral model, were developed to calculate the apparent conductance of ion exchangers-electrolytic solution suspension. The general characteristics of this electrolysis equipment were investigated. Especially fundamental equations were derived for the ion-concentration gradient developed in the depletion compartment at the steady state, as a function of feed-solution concentration, flow rate of depleted stream, applied voltage, total current, electrolysis efficiency, specific conductances of ion exchangers, membranes and solutions, particle-volume fraction, and cell geometry. (auth)

8244 (JAERI-1039) MUTUAL SEPARATION OF RARE EARTH ELEMENTS. Tomitaro Ishimori and Chin Taik Rhee (Japan Atomic Energy Research Inst., Tokyo). July 26, 1962. 6p.

The behavior of some rare earth elements was studied in an eight stage discontinuous counter-current-extraction where both acid and solvent concentrations were gradually changed. Nitric acid and bis(2-ethylhexyl)-orthophosphoric acid diluted with toluene were chosen for aqueous and organic media respectively. The results show that this technique can be used for enrichment of a definite rare earth element from rare earth mixture of multi-components. However, it seems to be less effective for final purification of the rare earth element. (auth)

8245 (NLCO-852) ROLE OF HYDROXIDE ION DURING STRIPPING OF URANIUM FROM TRI-n-BUTYL PHOSPHATE–KEROSENE SOLVENT INTO WATER. T. J. Collopy and R. K. Klopfenstein (National Lead Co. of Ohio, Cincinnati). Dec. 28, 1962. Contract AT(30-1)-1156. 19p.

Laboratory tests were conducted to evaluate the use of ammonium hydroxide to enhance the stripping of uranium from the organic (TBP-kerosene) phase into the aqueous phase in a simulated refinery operation. A series of boil-down tests was made to determine the maximum amount of NH_4OH that could be added without causing precipitation of uranic acid. Other tests were made to determine the point at which the NH_4OH could be added for maximum benefit during re-extraction, yet not cause precipitation. Equilibrations were made between uranium laden organic solvent and aqueous uranyl nitrate at various temperatures. Increased temperatures resulted in a shift in uranium distribution toward the aqueous phase. Thus it was shown that adding NH_4OH to the aqueous stripping agent (water) and increasing the temperature of re-extraction are additive, beneficial effects. (auth)

8246 (NP-12395) IMPROVEMENTS TO CEN MINIMIXER-SETTLER MODEL: EUROCHEMIC MODEL NO. 1. Eurochemic Technical Report No. 112. E. López-Menchero and J. Centeno (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium). Mar. 14, 1962. 18p.

A model based on the CEN minimixer-settler, described by R. De Witte et al., was developed. The general features of the CEN minimixer-settler were retained in the model, but the following improvements were made: individual regulation of the height of each mixing pump, introduction of a technique to achieve quicker sampling and the use of acid- and solvent-resistant, transparent KEL-F as the basic material of construction. To determine the individual stage efficiencies of the new model, tests were carried out using the system 10% TLA–5% octyl alcohol–Shellsol T/uranyl nitrate/nitric acid. Average stage efficiencies from 50% to 80% of a theoretical stage were reached for uranium stripping from the organic phase with 2 M HNO_3, in the range of uranium concentrations from 10^{-3} to 10^{-5} M/l, using contact times per stage between 0.5 and 4.0 min. This corresponds to organic phase flow rates as low as 415 and 60 cc/hr respectively (flow ratio ~1). (auth)

8247 (ORNL-3308) PEROXIDE-INHIBITED DECONTAMINATION SOLUTIONS FOR CARBON STEEL AND OTHER METALS IN THE GAS-COOLED REACTOR PROGRAM. Progress Report, November 1959–July 1962. A. B. Meservey (Oak Ridge National Lab., Tenn.). Jan. 2, 1963. Contract W-7405-eng-26. 57p.

A search for solutions suitable for dissolving uranium dioxide powder or lumps and yet noncorrosive enough to be used for decontaminating the carbon steel EGCR charge and service machines resulted in the development of buffered oxalate solutions of controlled temperature and pH, with hydrogen peroxide added to act as corrosion inhibitor, UO_2 oxidizer, and decontamination aid. Hydrogen peroxide acts either as a corrosion promoter or inhibitor, depending on factors such as its concentration, the ratio to other ingredients, acidity, temperature, the presence of complexing agents, and the ferric ion content of the solution. In general, oxalate-peroxide solutions for fission product decontamination from metal surfaces were superior to more conventional decontaminating solutions and had attractively low corrosion rates on carbon steel (less than 0.01 mil/hr). Solution instability, initially a serious drawback, was largely overcome. Of nearly a hundred formulations studied, the one having the best combination of long life, low corrosivity, high solvency for UO_2, decontamination power, safety, and ease of waste disposal was an aqueous solution of 0.4M oxalic acid, 0.16M ammonium citrate, and 0.34M H_2O_2, adjusted to pH 4.00 with ammonium hydroxide and used at 85 to 95°C. Similar solutions at lower pH, with increased H_2O_2 concentration to maintain noncorrosiveness, were successful decontaminants at 60°C when contact times were increased to several hours. Contaminated stainless steels heated to 500°C in helium resisted decontamination in noncorrosive reagents. Oxalate-peroxide solutions are currently recommended as UO_2 solvents and as general decontaminants for mild steel and aluminum surfaces in the GCR program, and for stainless steels which were not strongly heated while contaminated. These solutions may also find application in the decontamination of metals used in the aqueous reprocessing of radioactive nuclear fuels. (auth)

8248 (ORNL-3371) EVALUATION OF AUTOMATIC DATA PROCESSING IN THE FLUORIDE VOLATILITY PILOT PLANT. E. C. Moncrief and M. C. Hill (Oak Ridge National Lab., Tenn.). Jan. 2, 1963. Contract W-7405-eng-26. 24p.

Automatic data logging and digital-computer techniques were evaluated in the ORNL Fluoride Volatility Pilot Plant. The data reduction sequence consisted of encoding plant signals from conventional instrumentation, digitizing the encoded signals with an on-line automatic data logger, and processing the logged data off-line with a digital computer. Data reduction and computational codes were useful in disseminating process data, with photographic curve plots being the most efficient means. Considerable difficulty was experienced with logger output errors, which complicated the data processing and frequently resulted in erroneous results. After continuous operation of the data-processing sequence for 12 months it was concluded that output from a data logger is of limited use without recourse to a computer, loading of raw logger data to the computer and subsequent conversion to a useful form (engineering units) can account for up to 70% of total computer charges, and some backup to automatic data logging, either as continuous or manual recording, may be desirable because logger downtime may be as much as 5%. The use of the data reduction sequence will be continued in the pilot plant. Expanding the sequence to include on-line computation and process control features is not justified because of process limitations. (auth)

8249 (PAN-331/V) THE EXTRACTION OF IRON(III) FROM HYDROCHLORIC ACID SOLUTIONS BY TETRA-n-BUTYLAMMONIUM CHLORIDE IN VARIOUS DILUENTS. Wiktor Smułek (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). May 1962. 23p.

A study was made of the extraction of Fe(III) from hydrochloric acid solutions by tetra-n-butylammonium chloride in a number of diluents. From the experimentally determined extraction coefficient of Fe(k) and the activity of the extractant (a) the activity coefficient of the complex (y_c) was calculated. The effect of diluent on a, y_c, and k was discussed from the point of view of intermolecular interaction. (auth)

8250 (PAN-337/IV) TECHNOLOGICAL PROPERTIES OF POLISH STRONGLY BASIC ANION EXCHANGE RESINS. Kazimierz Majchrzak and Wincenty Korpak (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1962. 13p.

The usefulness of some Polish strongly basic anion exchange resins (SE-X2, 5, SE-X5, and SM-X5) for the sorption of uranium was investigated and compared with Dowex-X7,5. It was found that SM-X5, with the capacity of 3.47 meq/g or 230 mg U/g, is the best of those studied. It is also characterized by good mechanical strength and elution properties. (auth)

8251 (PAN-345/XVI) STUDIES ON THE SEPARATION OF IMPURITIES IN THE ZINC RECTIFICATION PROCESS BY MEANS OF RADIOACTIVE ISOTOPES. Karol Akerman, Marek Brafman, Henryk Fik, Jan Kitala, Maciej Nowak, and Andrzej Poczynajło (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). July 1962. 22p.

A short outline is given of the process of Zn redistillation in New Jersey type columns and its theoretical principles elaborated by Alexander Krupkowski. Practical conclusions arising from the mathematical expression of the process, performed on the basis of the theory, are summarized. A description is given of the experiments on the separation of high- and low-boiling-point impurities in Zn and the behavior of the basic constituent itself under normal work conditions. (auth)

8252 (PAN-360/IV) PHOTOREDUCTION OF THE URANYL ION ON THE STRONGLY BASIC ANION EXCHANGER. Kazimierz Majchrzak and Wincenty Korpak (Polish Academy of Sciences. Inst. of Nuclear Research Warsaw). Sept. 1962. 3p.

Reduction of the uranyl ion on the strongly basic anion exchanger Dowex 1 was investigated. The reduction was found to be promoted by sunlight and ultraviolet light. The process does not depress the exchange capacity of the resin, which means that its active groups do not become oxidized in it. (auth)

8253 (RT/CHI(62)19) REFABRICATION OF THORIA–URANIA FUEL ELEMENTS. I. PRODUCTION OF THORIUM–URANIUM(IV) OXALATE. G. Cogliati, R. De Leone, S. Ferrari, M. Gabaglio, and A. Liscia (Italy. Comitato Nazionale per l'Energie Nucleare. Divisione Materiali, Rome). Dec. 1962. 13p.

A method for producing thorium-uranium mixed oxide suitable for high density ceramic fuel elements is described. This method employs the continuous catalytic reduction of uranium(VI) nitrate to uranium(IV), the coprecipitation of uranium(IV) and thorium oxalate, the firing of the oxalate, and the sintering of the mixed oxide. Laboratory equipment, operated in order to collect the engineering data for the reduction of uranium(IV) nitrate with formic acid, is described and the collected data are reported. (auth)

8254 (TID-17657) DETERMINATION OF WEIGHT OF TOTAL MATERIAL TO BE PROCESSED IN PRIVATE REACTOR FUEL PROCESSING. F. H. Tingey (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). [nd]. Contract [AT(10-1)-205]. 4p.

A method of determining a factor for conversion of values obtained in underwater weighings of partially irradiated fuels to the appropriate corresponding weights in air is described. The associated bias and error that can be anticipated in the use of the procedure are also discussed. (J.R.D.)

8255 (Y-1408) EVALUATION OF DIETHERS AS URANIUM EXTRACTANTS. J. M. Googin, W. L. Harper, L. R. Phillips, and F. W. Postma (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.). Oct. 2, 1962. Contract W-7405-eng-26. 28p.

Some pertinent physical properties were determined for thirty-two diethers and related compounds whose structures indicated that they might be good uranium extractants. Correlation of these properties with structures indicates that the use of the carbon-to-oxygen atomic ratio as a guide to the extraction power of an ether cannot be extended beyond a particular homologous series nor used when the spacing of the oxygen atoms in the ether is changed. The dipole moment appears to be a factor in explaining the differences in the extraction power of compounds with the same carbon-to-oxygen ratio. The lower-membered dialkoxypentanes showed suitable physical properties and adequate uranium extraction capabilities. These were examined more thoroughly with respect to their use as uranium extractants in large-scale recovery operations. (auth)

8256 SOME FEATURES OF THE DISTRIBUTION OF EXTRACTED MATERIALS IN THE WASHING PORTION OF THE EXTRACTION–WASHING APPARATUS. S. M. Karpacheva and E. P. Rodionov. At. Energ. (USSR), 13: 486-91 (Nov. 1962). (In Russian)

Recent studies indicated that simultaneous extraction of several substances by organic solvents from an aqueous solution may result in a competition between these substances if the extraction agent forms chemical compounds with them. This fact is used to enhance the separation of the extracted materials. In view of the scarcity of data on the distribution in the washing portion of the extraction processes, a number of literature data were recalculated, determining the concentration distribution of the macroelements, such as nitric acid, uranyl nitrate, and of the microelements, e.g., Pu, between the aqueous phase and the TBP solution in kerosene. On the basis of these calculations, an approximate formula was derived for determining approximately the required number of extraction and washing columns. Difficulties were caused by the lack of sufficient information on certain data, such as the acidity of the raffinate, the exact location in the column where the extraction takes place, etc., repeated approximations must be made on the basis of the material balance. For exact calculations the change in the ratios of the various streams, caused by the volume changes occurring during the process must be taken into account. (TTT)

8257 LIQUID-LIQUID EXTRACTION OF BERYLLIUM. II. STUDIES OF BERYLLIUM–THIOCYANATE EXTRACTION. Wendell J. Biermann and Robert McCorkell (Univ. of Manitoba, Winnipeg). Can. J. Chem., 41: 112-16(Jan. 1963).

The partition of Be and Al between aqueous thiocyanate solutions and several organic solvents was determined under a variety of experimental conditions. From batch studies it was concluded that a two-solvent countercurrent extraction of Be from a thiocyanate solution should give good recovery of Be with effective separation from Al and, by inference, other inert gas configuration cations. (auth)

8258 THE REPROCESSING OF URANIUM FUEL MATERIALS. Heinz Anders. Chemiker Ztg., 86, No. 6, 192-4(1962). (In German)

The reprocessing of uranium fuel materials from zirconium-enriched reactor wastes by evaporation of UF_6 and its absorption in NaF are discussed. The U–Zr alloy is reacted with hydrofluoric acid and then fluorine gas. (M.C.G.)

8259 THE EXTRACTION OF URANIUM, CERIUM, ZIRCONIUM AND RUTHENIUM BY TRI-ISO-OCTYLAMINE FROM NITRIC ACID SOLUTIONS. A. Facchini, P. Gerontopulos, and L. Rigali (SNAM, Milan; CESNEF, Milan; and CAMEN, Pisa). Energia Nucl. (Milan), 9: 681-9(Dec. 1962). (In English)

The extraction of uranium (VI), cerium, zirconium, and ruthenium by tri-iso-octylamine diluted in xylene from nitric acid solutions is investigated. Extraction coefficients of uranium (VI) and of the individual fission product elements are given under varied extraction conditions, such as salting agent (HNO_3 or NH_4NO_3) concentration, amine concentration in the inert diluent, etc. (auth)

8260 PLUTONIUM ELECTROREFINING. Lawrence J. Mullins, Joseph A. Leary, Arthur N. Morgan, and William J. Maraman (Los Alamos Scientific Lab., N. Mex.). Ind. Eng. Chem., Process Design Develop., 2: 20-4(Jan. 1963). (LADC-5280)

The production of large amounts of high purity plutonium metal by bomb reduction techniques is a difficult and time-consuming task. Electrorefining processes were developed that provide good yields of the pure metal in a compact form of high density on either the 500-gram or 3.5-kg scale. Because of the operational simplicity, the method is also ideally suited to the economical processing of plutonium metal scrap. (auth)

8261 ION EXCHANGE IN MIXED SOLVENTS. ADSORPTION BEHAVIOUR OF URANIUM AND THORIUM ON STRONG-BASE ANION-EXCHANGE RESINS FROM MINERAL ACID-ALCOHOL MEDIA SEPARATION METHODS FOR URANIUM AND THORIUM. J. Korkisch and G. E. Janauer (Universität, Vienna). Talanta, 9: 957-85(Dec. 1962). (In English)

A summary is presented of important data hitherto reported on the anion-exchange behavior of uranium(VI) and thorium(IV) in mixed solvents, and the results of pertinent research work carried out in this laboratory. A detailed description is given of the adsorption behavior of these actinide elements on strong-base anion-exchange resins in mineral acid solutions containing aliphatic alcohols. Equilibrium studies show the distribution coefficients to vary greatly with the acid used, as is expected from the results earlier obtained in aqueous systems. In mixtures of a given mineral acid with different alcohols, the distribution coefficients depend on the alcohol percentage, as well as on the acidity of the solutions, and on the dielectric constants and chain lengths of the alcohols employed. The results of these investigations can be applied to the separation of thorium and uranium from each other and from practically all other cations and anions. Two of the separation methods developed have already found general application for the assay of uranium and thorium in materials of greatly varying composition. Finally, the general theoretical aspects of anion exchange in mixed solvents are discussed, and the results obtained for uranium and thorium are interpreted accordingly. (auth)

8262 ELECTROLYTIC SEPARATION OF Zr FROM Hf. M. V. Smirnov, V. E. Komarov, and A. N. Baraboshkin. Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural'sk Filial, No. 2, 23-8(1962).

Thermodynamic calculations based on the experimentally determined relationship between the equilibrium potentials of Zr and Hf in fused chlorides or mixtures of fluorides and chlorides showed that it is thermodynamically possible to separate Zr from Hf, but only in a fluoride-chloride electrolyte. At a given electrolyte composition, the lower the temperature, the lower the Hf content in Zr. At a constant temperature the degree of separation is determined by the ratio of Zr : Hf concentration in the cathode-adjacent zone of the electrolyte; this ratio should be maintained at the same level throughout the electrolyte. A lower Zr : Hf ratio in the cathode-adjacent zone would result in an increase in deposits with Hf. (OTS)

8263 ON THE EXTRACTION CHEMISTRY OF NITROSYLRUTHENIUM NITRATO COMPLEXES FROM AQUEOUS NITRIC ACID. E. Hallaba and Reda A. I. Azzam (Atomic Energy Establishment, Cairo). Z. Anorg. Allgem. Chem., 314: 53-60(Feb. 1962). (In English)

The distributions of nitrosylruthenium nitrate complexes in the TBP–HNO_3 system were studied using Ru^{106}. It was found to be affected by the concentration of HNO_3, NO_3, TBP, and the temperature. The results are represented and discussed. (auth)

8264 REACTOR FUEL PROCESSING. Volume 5, No. 4. Stephen Lawroski, ed. (Argonne National Lab., Ill.). Oct. 1962. 90p. (GPO) $0.55 (domestic), $0.70 (foreign). (One of the Technical Progress Reviews prepared quarterly for the Division of Technical Information, USAEC.)

A total of 5 sections is included in the fuel processing

review. Separate abstracts were prepared for each section. (J.R.D.)

8265 COMMERCIAL ASPECTS OF FUEL PROCESSING. p.1-6 of "Reactor Fuel Processing. Vol. 5, No. 4."

The status of plans for the first privately owned fuel-processing plant is reviewed. The plant is planned for a low-population area in New York. Other discussion is presented concerning the relations of processing plant size with economy of operation. Data are included for use in economic comparison of aqueous radiochemical fuel processes. A discussion is also included concerning fuel-cycle economics in which data are given on base charges for enriched U as UF_6, estimated fuel-cycle costs for selected power reactors, and on the effects of the 1962 price reduction for U^{235}. A description of the receiving facility for various fuels at the Savannah River Plant is also included. (J.R.D.)

8266 RESEARCH AND DEVELOPMENT ON AQUEOUS PROCESSING. p.7-29 of "Reactor Fuel Processing. Vol. 5, No. 4."

A review of developments in solvent-extraction recovery of Pu and U from irradiated fuels is presented. Discussions are included concerning preliminary processing of fuel by mechanical or chemical operations. Separation processes are also discussed, and it is noted that organic solvent extraction is usually used for separation of Pu, Th, and U; however, ion exchange and precipitation may be used to effect separation of one element from another. Flowsheets are included to illustrate the flow pattern in the Redox 3-cycle process, the Purex 2-cycle process, transuranium-element separation, and a proposed precipitation process for sodium fluozirconate precipitation. Information is also included on aqueous process instrumentation, plant design and operation, construction materials corrosion, and corrosion problems in waste processing. (J.R.D.)

8267 RESEARCH AND DEVELOPMENT ON NONAQUEOUS PROCESSING. p.30-51 of "Reactor Fuel Processing. Vol. 5, No. 4."

Various types of processes based on the volatilities of UF_6 and PuF_6 were proposed for processing irradiated fuels. A discussion is presented concerning nonaqueous processes such as the nitrofluor process, the fused-salt fluoride-volatility process, and chloride-volatility processes. Pyrometallurgical processes such as melt refining and liquid metal-salt solvent techniques are examined. Other nonaqueous processes are discussed which are applicable principally to oxide and carbide reactor fuels. These processes generally utilize gases, molten salts, and liquid metals as reagents and reaction media. Subsections are included concerning processing of mixed Pu–U oxides and carbide fuels. (J.R.D.)

8268 WASTE DISPOSAL. p.52-71 of "Reactor Fuel Processing. Vol. 5, No. 4."

A discussion of tank-storage management of high-level-activity liquid wastes is presented in which information is given on classification of wastes, service life of tanks, economic aspects, and hazards of tank storage. Other discussion is included on treatment of liquid wastes by adsorption, ion exchange, and reduction to solids, and on final disposal methods. Information is also included on recovery of fission products. A proposed flow diagram for Sr recovery from Purex 1 WW is given along with discussion of Hanford Purex waste handling, shipment of Hanford fission products, and incorporation of Cs^{137} in glass. (J.R.D.)

8269 PRODUCTION OF URANIUM, THORIUM, PLUTONIUM, AND THEIR COMPOUNDS. p.72-87 of "Reactor Fuel Processing. Vol. 5, No. 4."

A review is presented in which developments in processes for recovery of U from ores, UO_2 production, PuF_4 production, and preparation of uranium carbides are reported. Developments in production of U metal, recovery of Th from ores, and electrorefining Pu metal are also reported. (J.R.D.)

8270 PROCESS FOR REFINING METAL POWDERS BY ELECTROLYSIS. (to Deutsche Gold-Und Silber-Scheideanstalt Vormals Roessler). British Patent 910,826. Nov. 21, 1962. Priority date July 4, 1958, Germany.

A simple, economical process is outlined for electrorefining powders of metals of the fourth, fifth, and sixth secondary groups of the Periodic Table, particularly the Ti/Zr group. The process comprises dissolving or suspending the powder in a molten alkali or alkaline earth metal halide in the anode chamber, and carrying out the electrorefining with a diaphragm between the anode and cathode spaces. (D.L.C.)

8271 GASEOUS DISPOSAL PROCESS. R. F. Ryan, F. R. Thomasson, and J. H. Hicks (to U. S. Atomic Energy Commission). U. S. Patent 3,074,776. Jan. 22, 1963.

A method is described of removing gaseous radioactive Xe and Kr from water containing O. The method consists in stripping the gases from the water stream by means of H flowing countercurrently to the stream. The gases are then heated in a deoxo bed to remove O. The carrier gas is next cooled and passed over a charcoal adsorbent bed maintained at a temperature of about −280°F to remove the Xe and Kr. (AEC)

8272 LOW TEMPERATURE PROCESS FOR THE REMOVAL AND RECOVERY OF CHLORIDES AND NITRATES FROM AQUEOUS NITRATE SOLUTIONS. J. E. Savolainen (to U. S. Atomic Energy Commission). U. S. Patent 3,075,825. Jan. 29, 1963.

A method is described for reducing the chloride content of a solution derived from the dissolution of a stainless steel clad nuclear fuel element with an aqua regia dissolution medium. The solution is adjusted to a nitric acid concentration in the range 5 to 10 M and is countercurrently contacted at room temperature with a gaseous oxide of nitrogen selected from NO, NO_2, N_2O_3, and N_2O_4. Chloride is recovered from the contacted solution as nitrosyl chloride. After reduction of the chloride content, the solution is then contacted with gaseous NO to reduce the nitric acid molarity to a desired level. (AEC)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

Refer also to abstract 9912.

8273 (AFSWC-TDR-62-117) REMOTE HANDLING TECHNOLOGY AND EQUIPMENT INVESTIGATION. Raymond S. Karinen, James Figenshau, William Hainer, Robert Sullivan, Edward Hamernik, Raymond Hakomaki, and Anthony Novak (General Mills, Inc. Electronics Div., Minneapolis). Nov. 1962. Contract AF29(601)-5219. 234p.

The subject of remote handling is discussed. An extensive search was made of existing technical literature plus personal and letter contacts of many of the major remote handling equipment suppliers throughout the United States. A general description of the types of remote handling equipment in existence, illustrations and specifications of standard manipulators available, lists of remote handling equipment manufacturers throughout the world and a comprehensive bibliography of available literature are presented. Technological progress and advanced developmental concepts in the field of remote manipulation are also described. (auth)

8274 (EURAEC-480) DESIGN AND CONSTRUCTION OF A HIGH PRESSURE GAS CIRCULATOR. Topical Report No. 2. N. Adorni and L. Cravarolo (Centro Informazioni Studi Esperienze, Milan). Sept. 1962. Work Performed under United States – Euratom Joint Research and Development Program. Contract 060-61-7RDI. 65p. (CISE-R-59)

A twin centrifugal blower was designed for argon circulation in a pressurized loop. The blower characteristics are: head, 4.0 kg/cm^2; capacity, 45 m^3/hr at 20°C and 22 kg/cm^2; maximum leakage, 1000 NTP cm^3/hr; rotational speed, 8000 rpm; and driving motor power, 14.7 kw. Test results are given. (D.L.C.)

8275 (HW-SA-2149) PRODUCTIVE MAINTENANCE THROUGH VIBRATION ANALYSIS. W. F. Emery (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [nd]. Contract [AT(45-1)-1350]. 7p.

It is noted that productive maintenance is the art of eliminating trouble before it occurs. A vibration analytic technique for checking parts of machines while in operation is described. Vibration analysis is not considered a panacea but an additional tool for use in any productive maintenance program. (J.R.D.)

8276 (HW-SA-2270) NEW METHOD SIMPLIFIES INDUCTION HEATING CALCULATIONS FOR MAGNETIC CHARGES. V. F. FitzPatrick (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1961]. Contract [AT(45-1)-1350]. 7p.

An equation is presented for calculating induction heating in cylindrical magnetic charges. Procedures for hollow and rectangular charges are also given. The method shortens calculation time with no loss of accuracy. (J.R.D.)

8277 (IS-464) A DIAPHRAGM PUMP FOR LIQUID METAL SERVICE. D. E. Westerheide, J. C. Clifford, and George Burnet (Ames Lab., Ames, Iowa). Oct. 1962. Contract W-7405-eng-82. 16p.

The use of centrifugal and electromagnetic pumps for liquid metals is briefly reviewed. Details are provided on the construction and operation of a two-stage diaphragm pump successfully used for the first time in liquid metal service. From the results of a 5,376 hr test of the pump it was concluded that it is well suited to the pumping of liquid metals at low flow rates where pulsating flow can be tolerated. Operating temperatures and pressures are limited only by the availability of suitable materials of construction. (auth)

8278 (LA-2761) MOLTEN PLUTONIUM PUMP EXPERIMENT. J. E. Deverall and G. L. Caldwell (Los Alamos Scientific Lab., N. Mex.). Aug. 1962. Contract W-7405-eng-36. 91p.

The Molten Plutonium Pump Experiment was a subcritical mock-up of a reactor core in which a plutonium–iron alloy was circulated by means of a sodium lift pump. Sodium for the lift pumping was circulated by an E. M. pump in an isothermal loop at 500°C. The purpose of the test was to study pump characteristics, instrumentation, sodium-fuel separation, and fuel transfer systems. Operational characteristics of the core and fuel transfer system were observed by a closed, gamma ray television circuit, radiographs, and a fuel reservoir level indicator. Motion pictures were taken of the TV screen to provide a permanent record. All phases of the study were completed before a leak at the core necessitated shutdown. (auth)

8279 (LAMS-2793) A PARAMETRIC SURVEY OF TUBE AND FIN TYPE RADIATORS. R. C. Anderson and B. J. Henderson (Los Alamos Scientific Lab., N. Mex.). Oct. 1962. Contract W-7405-eng-36. 43p.

The methods employed and the results obtained in a parametric survey of the characteristics of radiators to be used in dumping excess heat from reactors for space applications are reported. (auth)

8280 (N62-11797) STUDIES ON THE RADIOACTIVE DATING OF THE LUNAR SURFACE. Status Report. P. Eberhardt and J. Geiss (Bern. Universität. Physikalisches Institut). Jan. 19, 1962. 7p.

A gas extraction and purification apparatus, suitable for remote control, was developed for the determination of isotope concentrations of rare gases in lunar surface material. The apparatus can be used to obtain radiation ages from abundances of argon, neon, and helium isotopes and argon-potassium, helium-uranium-thorium, and xenon-iodine ages can be estimated. The apparatus uses chemical energy without an additional energy supply and neither gives off gases nor creates mechanical shocks. The apparatus consists primarily of a molybdenum tube with a titanium sponge mounted inside it. The system is enclosed in a cylindrical box to prevent leakage of gases from chemical reactions; total weight is 600 g, which can probably be reduced about 30 percent. A sample is melted and degassed in the tube, using heat from a FeO-Al reaction. The titanium sponge absorbs all but the rare gases. The apparatus was tested by extracting argon from chondritic samples. The yield for Ar^{40} was better than 98 percent; for Ar^{36} and Ar^{38}, better than 90 percent. The apparatus can also be used for determining of primordial rare gases and volatile components and a detailed study of the lunar atmosphere. Remote controlled dating methods, developed for lunar investigation, could be applied to other bodies of the solar system. (auth)

8281 (NP-11896) CIVIL ENGINEERING BIBLIOGRAPHY ON THE DESIGN AND CONSTRUCTION OF NUCLEAR FACILITIES. Richard J. Smith, ed. (American Society of Civil Engineers, New York). Dec. 1961. 66p.

A total of 459 references to unclassified reports and published literature is presented on civil engineering and architectural aspects of the nuclear field. The period from 1945 to early 1959 is thoroughly covered; later information is represented by several selected citations to bibliographies and publications of wide scope. An author index is provided. (auth)

8282 (NYO-4816) LABORATORY PERFORMANCE OF THE MIKRO-PULSAIRE COLLECTOR (MODEL J-9-6A). Richard Dennis, Edward Kristal, Glenn A. Peters, and Leslie Silverman (Harvard Univ., Boston. Air Cleaning Lab.). June 15, 1962. Contract AT(30-1)-841. 60p.

Performance data are presented for a fabric filter (Mikro Pulsaire) cleaned by intermittent reverse air pulses directed into the clean air exit of the filter tube. Results of tests with resuspended fly ash, vaporized silica, and freshly generated iron oxide fume showed that at fabric face velocities of 8 ft per min and inlet dust loading in the range of 1.0 grain per ft^3 fly ash and vaporized silica could be filtered at constant (equilibrium) resistances, 3 and 5 in. water respectively. No equilibrium resistance could be attained with iron oxide fume. The jet air cleaning system was controlled in three ways by varying (1) compressed air pressure, (2) duration of compressed air pulse, or (3) frequency of pulse application. Test data showed that fabric resistance varied inversely with the square of the compressed air pressure and inversely with the square root of the pulse frequency. Pulse duration had no effect on resistance. Fabric resistance was moderately dependent on dust deposition rate, increasing as the fourth root of the inlet loading. Observations and experimental data indicated that initial flexing of tubes was the principal cleaning mechanism. Calculated reverse air velocity through the fabric appeared too low, 16 ft per minute, to cause significant dust dislodgement. Comparison of the Micro-Pulsaire collector with a Hersey type blow ring unit indicated that total power requirements were greater for air pulse cleaning. On the basis of estimated total yearly costs including major capital and operating costs and assuming equal maintenance charges, it appeared that the Mikro-Pulsaire device was less expensive for air handling capacities of 3000 ft^3 per minute or lower and more expensive for capacities greater than 8000 ft^3 per minute. However, the manufacturer's claim that air pulse cleaning reduces overall maintenance appears reasonable. It suggests that performance and operating costs would be similar for both air pulse and blow ring type devices in many applications. (auth)

8283 (TID-17208) CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. Progress Report No. 46. A. G. Pickett and C. L. Whitney (Southwest Research Inst., San Antonio). Oct. 15, 1962. Contract AT (30-1)-2140. 7p.

A fatigue test on a large-size pressure vessel is reported. Internal pressure was cycled from zero to 6400 psig at the rate of 30 cycles/hour. Sonic and magnaflux inspections were performed at 500, 1000, 1530, and 3500 cycles. The sonic inspection indicated that a small surface defect at 180° on the inside corner radius of Nozzle 2 was growing but no crack indications were found by magnaflux. At 3603 cycles the vessel fractured. Inspection by sonic and magnaflux methods showed no surface cracks other than those originated by the fracture. (L.T.W.)

8284 CRYOSTAT FOR EXPERIMENTS IN THE TEMPERATURE RANGE FROM −130°C TO −190°C WITH AN ARRANGEMENT FOR THE PREVENTION OF FROST FORMATION. Z. Rogalska (Inst. of Nuclear Physics, Krakow). Acta. Phys. Polon., 22: 369-75(Oct. 1962). (In English)

A cryostat is described which was used at −156°C during measurements of slow neutron scattering by liquid methane. The cryostat was constructed chiefly of brass and has ports for introducing methane and mounting a thermocouple. Frost was prevented from forming on the cryostat parts through which the neutron beam passed during the measurements. The transmission of the neutrons through the cryostat is ~70%. (D.L.C.)

8285 ELECTRIC PROPULSION. Ernst Stuhlinger (NASA Marshall Space Flight Center, Huntsville, Ala.). Astronautics, 7: No. 11, 60-8(Nov. 1962).

The state of development of electric propulsion systems is reviewed. Electrothermal, electrostatic, electromagnetic, and heavy-particle systems are treated; and present ion engines of the surface-ionization and bombardment types are deemed usable for modest space missions. Electric power systems and the lag in their development are also discussed. 32 references. (D.C.W.)

8286 CONTRIBUTION OF THE SOLID-BODY FLOW IN AXIAL TURBO-MACHINES. K. Bammert and K. Fiedler (Technische Hochschule, Hanover). Atomkernenergie, 7: 439-46(Dec. 1962). (In German)

In the case of nuclear power plants economical operation is dependent on the employment of units having a very high output. Large output figures with thermal turbomachines mean large weight flow which in turn require, especially in the last stages, a small hub to tip ratio, if a multi-flow design is not adopted. However, on account of the considerable cost increase, this is used only in cases where the hub to tip ratio cannot be reduced any further. There may be several reasons against a reduction of the hub ratio. If the blading is of a design causing a flow as in a potential vortex, then the limit of the hub ratio reduction is determined by the development of a negative degree of reaction at the blade root, in which case the pressure in front of the impeller is lower than that behind it. With the type of flow investigated, the degree of reaction throughout the blade length is nearly constant, i.e., the flow in question is a flow according to the "Solid Body" principle. It was found that the axial component of the speed varies throughout the blade length and there may be a point where it disappears. As there is interrelation between the speed of a machine and its weight flow, this phenomenon, which depends on the hub ratio, defines a minimum weight flow below which a flow according to the Solid Body principle is no longer possible. The Solid Body flow requires different bladings from stage to stage. Therefore, another type of flow was investigated with which the working medium moves according to the Solid Body principle behind the guide wheel, whereas in the impeller its state is changed in such a way that a flow distribution reproduced in all stages is achieved. (auth)

8287 INVESTIGATION OF AEROSTATIC AXIAL BEARINGS FOR TURBO-MACHINERY. E. Loch (Escher Wyss A. G., Zurich). Atomkernenergie, 7: 489-95(Dec. 1962). (In German)

The purpose, properties, and industrial application of gas-lubricated bearings are discussed. For a pressurized thrust bearing with separate supply-nozzles leading directly into the bearing clearance, the character of the compressible flow was investigated. It is shown, that the laminar flow of gases in narrow slots can be described by potential theory. The pressure distribution, load capacity, and flow rate for a slot with parallel walls formed as a sector of an annulus having one source (supply nozzle) were calculated for different sector-angles and compared with test results. (auth)

8288 A GASIFIER FOR OBTAINING PRESSURES UP TO 100 atm USING LIQUID HELIUM. V. K. Tkachenko and A. I. Filimonov (Inst. for Physical Problems, Academy of Sciences, USSR). Cryogenics, 2: 359-60(Dec. 1962).

Design details are set forth for a gasifier which is contained within a helium Dewar. Helium-3 or helium-4 gas can be produced under pressure by the apparatus. (R.J.S.)

8289 HOLDUP STUDIES IN A PULSED SIEVE-PLATE SOLVENT EXTRACTION COLUMN. G. A. Sehmel and A. L. Babb (Univ. of Washington, Seattle). Ind. Eng. Chem., Process Design Develop., 2: 38-42(Jan. 1963).

The total holdup of dispersed organic phases in a pulsed sieve-plate solvent extraction column was intensively studied in one-column geometry to determine the actual phase velocities. The column was 2 inches in diameter and contained 43 plates with a 2-inch plate spacing. The plates were made of 19-gage, Type 304 stainless steel perforated with $\frac{1}{8}$-inch-diameter holes to give a 23% free area. Hexane, benzene, and methyl isobutyl ketone were used as the individual dispersed phases with water as the continuous phase. The effects of pulse amplitude, phase flow rates, and pulsation frequency on the dispersed phase holdup were studied. Dispersed phase holdup was found to be a minimum at the transition frequency between mixer-settler and emulsion types of column operation. For the system studied, this frequency can be predicted from a simple empirical correlation. The results have been used in the analysis of continuous phase longitudinal mixing data to be reported later. (auth)

8290 EXCAVATION BY NUCLEAR EXPLOSIONS. Milo D. Nordyke (Univ. of California, Livermore). New Scientist, 15: 36-40([1962]). (UCRL-6578(Rev. II))

The economic advantages of nuclear explosions in evacuation are described briefly. The experience gathered with nuclear cratering detonations at the Nevada Test Site is reviewed, and correlations of crater dimensions with yield are given. For charges in the region of 1 kiloton, $W^{1/3}$ scaling best correlates all data. From the graphs, it is shown that a 1-megaton explosive would produce a crater ~2400 ft dia and 560 ft deep in rock. Radioactivity release, air blast, and seismic shock are considered. (D.L.C.)

8291 THE INVESTIGATION OF SAND MOVEMENT USING RADIOACTIVE GLASS SAND IN KASHIMA HARBOR. Shoji Sato and Norio Tanaka (Harbor Technics Research Inst., Ministory of Japan). Radioisotopes (Tokyo), 11: 355-62(Nov. 1962). (In Japanese)

In Japan, since radioactive tracers were used to investigate the sand movement at Tomakomai Harbor in 1954, they have been used in the ports and harbors of Irako, Isohama, Kashima, and Niigata in order to get the fundamental data necessary for harbor construction. The principle of this method is to put on the sea bed radioactive tracers which have the same specific gravity and size diameter as natural sand, and to trace their movement due to waves and currents by the radiation measuring instrument. The method of making, injecting, and tracing radioactive tracers at Kashima Harbor is described. The radioactive tracers were obtained by irradiating glass containing cobalt or scandium in an atomic pile. In order to inject tracers on the sea bed without radiation hazards, the cylindrical injection apparatus containing tracers is hanged from boat. When it reaches the sea bed, a glass beaker is broken by projections and tracers are put off on the sea bed. In the case of removing tracers from small polyethylene bags into a larger one and from the bag into the injection apparatus, a wooden box filled with sand, a long iron nipper, and an electric heater or a heated iron bar are used. The movement of tracers on the sea bed is traced with a watertight underwater detector. This detector has two G-M tubes of 40 centimeters long and 5 centimeters diameter and is connected with a cable of 200 meters long as ratemeter on the boat. As an example of the investigations conducted in Kashima Harbor, the results as to radioactive tracer of about 30 millicuries injected on the sea bed of 9 meters deep are shown. In a comparison of results with the characteristics of waves and currents, sand in 9 meters depth is known to be moved to the shore in accordance with the direction of wave when the wave height is about 2.5 meters, but a part of it is moved parallel with the shore line and another part is moved in the direction of wave when the wave height is about 1.5 meters. (auth)

8292 CONTROLLED FLASH HEATING OF METAL FILAMENTS. R. A. Pasternak, Edward C. Fraser, Bjoern Bergsnov-Hansen, and H. U. D. Wiesendanger (Stanford Research Inst., Menlo Park, Calif.). Rev. Sci. Instr., 33: 1320-3(Dec. 1962).

A simple inexpensive instrument for flash heating metal filaments was designed which is being used in studying sorption phenomena at very low pressures and in measuring heat capacities and total emissivities of metals. The instrument permits selecting both absolute heating rates and their time dependence; in particular, filament temperatures increasing linearly with time can be obtained. Furthermore, the heating circuit allows the attainment of a preselected maximum filament temperature without appreciable over-shooting. The concept and design of the device are described. (auth)

8293 A 170-LITER HEAVY LIQUID BUBBLE CHAMBER. A. G. Prodell (Brookhaven National Lab., Upton, N. Y.) and J. Steinberger. Rev. Sci. Instr., 33: 1327-30 (Dec. 1962).

A 170-liter Columbia-Brookhaven heavy liquid bubble chamber has been operated at Brookhaven National Laboratory in a magnetic field of 15 kG. The bubble chamber was designed with a retro-directive system of illumination which produced bright field optics. Details of the chamber, the magnet, and the optical system are given. (auth)

8294 PLASMA AND ION BEAM CHARACTERISTICS OF THE DYNAMAG ION SOURCE. Edwin M. Kellogg and Karl E. Eklund (Radiation Dynamics, Westbury, N. Y.). Rev. Sci. Instr., 33: 1338-9(Dec. 1962).

A description of an ion source of the duoplasmatron type is given. Experimental results related to the plasma density distribution in the region between the intermediate electrode and the anode are given and discussed. Ion beam behavior in the extractor region as a function of extraction potential and total current was studied. Also, ion beam space-charge neutralization by secondary electrons was looked for but not observed under present conditions. (auth)

8295 CONSTANT ACCELERATION TRANSDUCER EMPLOYING NEGATIVE FEEDBACK FOR USE IN "MÖSSBAUER EXPERIMENTS." David Rubin (Ford Motor Co., Dearborn, Mich.). Rev. Sci. Instr., 33: 1358-60(Dec. 1962).

A triangular voltage is integrated and the output current fed to a vibrator so as to produce linearly changing velocities. The output voltage of a velocity pickup coil is then compared to the triangular input voltage in a negative feedback arrangement which further linearizes the velocity. (auth)

8296 IMPROVED PRECISION CHUCK FOR SECTIONING DIFFUSION SAMPLES. H. P. Layer and R. O.

Meyer (Univ. of North Carolina, Chapel Hill). Rev. Sci. Instr., 33: 1458-9(Dec. 1962).

A chuck is designed for securing diffusion samples which are to be sectioned on a lathe. The chuck allows adjustments to maintain the sample face perpendicular to the axis of rotation and to keep the sample centerline approximately coincident with the center of rotation. The adjustments can be accomplished in 2 minutes. (D.L.C.)

8297 THERMAL CONTACT WITH ELECTRICAL INSULATION FOR CRYOGENIC APPLICATIONS. R. L. Chaplin and P. E. Shearin (Univ. of North Carolina, Chapel Hill). Rev. Sci. Instr., 33: 1466-7(Dec. 1962).

An extremely good thermal contact which is electrically insulated was developed for connection between electrical wire and a low-temperature reservoir. In this contact, a Kovar seal is mounted on a liquid N_2 container with the terminal ends in intimate contact with the coolant and the opposite terminal ends forming binding posts for electrical leads. The amount of power dissipation per unit temperature change could be increased by soldering copper foils to the terminals in the liquid N_2. (D.L.C.)

8298 THIN LIQUID β SOURCE FOR CORRELATION STUDIES. Richard I. Johnson (Univ. of California, Livermore). Rev. Sci. Instr., 33: 1474-5(Dec. 1962). (UCRL-7011)

A method is given for constructing thin liquid sources of high electron transparency, minimum backscatter, and complete orientational freedom for β-γ angular correlation measurements. The sources comprise three-layer mica-paraffin sandwiches with the source sealed in a cavity formed by the two outer layers and a hole in the middle layer. (D.L.C.)

8299 LIQUID-TIN TOEPLER PUMP FOR TRANSFER OF HIGH-PURITY HELIUM. W. Brown, E. Hanson, and L. Passell (Univ. of California, Livermore). Rev. Sci. Instr., 33: 1475-6(Dec. 1962). (UCRL-7008)

A liquid-tin Toepler pump was chosen for transfer of helium from low-pressure storage flasks to a high-pressure proportional counter, because it gives extremely low contamination and is trapless. A vacuum of 10^{-5} mm Hg above the liquid-tin piston can be held while the pump is cycled. The pump has a displacement volume of 2 liters and is designed to operate at pressures up to 150 psi. (D.L.C.)

8300 BERYLLIUM WINDOW FOR GAMMA RAYS IN A LIQUID-HELIUM CRYOSTAT. Juergen Heberle (Argonne National Lab., Ill.). Rev. Sci. Instr., 33: 1476-7(Dec. 1962).

Two commercial x-ray windows (0.040-in. thick beryllium disk brazed into a Monel frame) were soft-soldered into ports in a stainless steel cryostat. Gamma rays are passed through the windows to a Mössbauer absorber submerged in liquid helium. No leaks were detected after 18 cycles to 4.2°K, and the transmission of 14-kev protons is >98%, as compared to only ~50% for 0.010-in. aluminum. (D.L.C.)

8301 AN EXPERIMENTAL INVESTIGATION OF AN IMPROVED VORTEX COOLING DEVICE. Thomas A. Blatt (Northern Research and Engineering Corp., Cambridge, Mass.). ASME Preprint Paper No. 62-WA-200. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 8p. $1.00.

Results of a development and performance investigation on a vortex cooling device, exhibiting significant performance increases over the conventional Hilsch tubes, are presented. In the core of the vortex flow field, greater than isentropic temperature depressions (corresponding to the same overall pressure ratios) are obtained, producing a simple, high-potential, low-capacity, refrigeration unit. Improvements on conventional vortex tubes are made by confining the vortex flow field without extracting cold flow and by adding a radial diffuser to the end of the shortened tube. Operating characteristics of two test units are presented. The obvious advantage of this cooling device (called a vortex cooler) is that it possesses no moving parts. Thus, in those applications requiring absolute reliability (cooling of infrared cells in missiles, for example), the vortex cooler may be preferred to a more complex, more efficient device. It may also be preferable in low-heat-transfer, high-temperature difference applications for which rotating machinery is unsuited. (auth)

8302 EXPERIMENTAL UNIT FOR STUDY OF HIGH-TEMPERATURE COMBUSTION OF COAL FOR MHD POWER GENERATION. D. Bienstock, R. C. Kurtzrock, R. J. Demski, and J. H. Field (U. S. Bureau of Mines, Pittsburgh). ASME Preprint Paper No. 62-WA-147. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 8p. $1.00.

An experimental cyclone furnace for studying high-temperature combustion of pulverized coal with oxygen-enriched air and seeded with alkaline salts is described. Temperatures of 4000°F and higher will be attempted. The objectives of the study are to determine the nature and disposition of the slag deposits downstream from the furnace, extent of corrosion of various boiler-tube materials at wall temperatures of 300 to 1700°F on exposure to the highly alkaline products of combustion, and the distribution and possible recovery of the seeding material. (auth)

8303 THE INFLUENCE OF THE EQUILIBRIUM DISSOCIATION OF A DIATOMIC GAS ON BRAYTON-CYCLE PERFORMANCE. T. A. Jacobs (Aerospace Corp., El Segundo, Calif.) and J. R. Lloyd. Preprint Paper No. 62-WA-95. New York, The American Society of Mechanical Engineers, 1962. 3p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

By employing the Lighthill "ideal dissociating gas" approximation, the influence of the equilibrium dissociation of a diatomic molecule on Brayton-cycle performance is demonstrated. For low-temperature ratios it is shown that the use of a suitably selected molecule results in a significant improvement in cycle thermal efficiency. (auth)

8304 A DESIGN ORIENTED OPTIMIZATION OF SIMPLE TAPERED RADIATING FINS. W. C. Reynolds (Stanford Univ., Calif.). Preprint Paper No. 62-WA-192. New York, The American Society of Mechanical Engineers, 1962. 9p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Results of extensive numerical studies of simple linearly tapered radiating fins are presented in a novel design-oriented manner. A noniterative optimization procedure is made possible by this presentation scheme. The optimization of fin geometry allows for consideration of associated structure whose weight depends on the fin length. The importance of considering this structure in selecting fin geometry is demonstrated. (auth)

8305 IMPROVEMENTS IN OR RELATING TO WINDING APPARATUS. Herbert Chilvers Knights (to United Kingdom Atomic Energy Authority). British Patent 911,635. Nov. 28, 1962. Filed Jan. 15, 1960.

A cable winding apparatus is provided for a fluid-conducting hose having an electrically conducting lead inside the hose. Two winding reels are arranged to be rotated together

on a common axis. The hose part of the cable is terminated on the first reel in connection with a fluid coupling. The electrically conducting lead continues from the first reel around the second reel, which it leaves tangentially, and passes to a fixed supply point. (R.J.S.)

8306 MECHANICAL OSCILLATOR. Denis Breton and Jean-Claude Carre (to Commissariat à l'Energie Atomique). British Patent 911,933. Dec. 5, 1962. Priority date Oct. 30, 1959, France.

A mechanical oscillator is designed which gives both sinusoidal and square waveforms. The oscillator comprises first and second members mounted on a stationary frame, driving means oscillating the first member, means for connecting first and second members, and change-over means for either permanent connection between the members or connection of the first member to the second member for single half-oscillations of the second member at intervals separated by an uneven number of half-oscillations of the first member. (D.L.C.)

8307 IMPROVEMENTS IN OR RELATING TO PRESSURIZERS. (to Babcock and Wilcox Co.). British Patent 913,654. Dec. 19, 1962. Priority date Feb. 14, 1958, United States.

A pressurizer is designed for controlling the pressure in a pressurized water reactor. The pressurizer comprises a pressure chamber, heating means for boiling liquid in the lower portion of the chamber, a surge line, a spray nozzle in the upper portion of the chamber, and means for regulating the operation of the heating means and the nozzle flow to control the pressure. (D.L.C.)

8308 IMPROVEMENTS IN WATER TUBE BOILERS FOR NUCLEAR POWER PLANTS. Andre Huet. British Patent 914,048. Dec. 28, 1962. Priority date May 5, 1958, France.

A water tube boiler is designed which comprises a plurality of groups of tubes in a vertical hollow cylindrical casing. The tubes of each group are helically coiled about the axis of the casing to define a cylinder of a diameter different from that of the other tube groups. Each end of the tubes of each group is connected to a vertical header disposed tangentially to the defined cylinder. The pitch and arrangement of the tubes are designed so that uniform heat extraction and heating are obtained. (D.L.C.)

8309 IMPROVEMENTS IN OR RELATING TO CONTAINERS FOR LIQUEFIED GASES. Pierre Roubeau, Olivier Testard, Maxime Givelet, Gilles Aubert, Albert Recule, and Roger Robert (Commissariat à l'Energie Atomique). British Patent 914,219. Dec. 28, 1962. Priority date Mar. 22, 1960, France.

A reservoir for liquefied gases is designed which permits frequent withdrawals without frosting over of valves or tubes. The reservoir comprises a vessel having a double wall with a low vacuum, a heat-reflecting screen, and an active carbon bed in its interior. The upper part of the vessel terminates in a neck with a collar for gas discharge and a hollow bush filled with insulation material. (D.L.C.)

8310 IMPROVEMENTS IN AND RELATING TO TUBULOUS VAPOUR GENERATORS. (to Babcock and Wilcox Ltd.). British Patent 914,748. Jan. 2, 1963. Priority date Apr. 18, 1958, France.

A vapor-generating tube bank is arranged within a pressure vessel for convective heating by a stream of fluid. (R.J.S.)

8311 IMPROVEMENTS RELATING TO THE LUBRICATION OF EQUIPMENT WHICH IS EXPOSED TO IONISING RADIATION. Neville John Hunter and Derek Illing (to British Petroleum Co. Ltd.). British Patent 914,772. Jan. 2, 1963. Filed Jan. 29, 1960.

A lubricant for equipment exposed to radiation is an oil extracted from a crude petroleum vacuum distillate or a deasphalted vacuum residue. A solvent is used that preferentially extracts aromatic hydrocarbons from mixtures of aromatic hydrocarbons with nonaromatic hydrocarbons. (R.J.S.)

8312 REMOTE CONTROL MANIPULATOR. Raphael T. Coffman (to U. S. Atomic Energy Commission). U. S. Patent 3,065,864. Nov. 27, 1962.

The patent covers a remote-control manipulator in which a tool is carried on a tube at an end thereof angularly related to the main portion of the tube and joined thereto by a curved section. The main portion of the tube is mounted for rotation and axial shifting in a wall separating safe and dangerous areas. The tool is actuated to grasp and release an object in the dangerous area by means of a compound shaft extending through the tube, the shaft having a flexible section extending through the curved section of the tube. The tool is moved about in the dangerous area by rotation and axial movement of the main portion of the tube. Additional movement of the tool is obtained through axial shifting of the shaft with respect to the tube through which it extends. (AEC)

8313 THERMOELECTRIC GENERATOR WITH ENCAPSULATED ARMS. William J. van der Grinten and Erwin Fischer-Colbrie (to General Electric Co.). U. S. Patent 3,070,644. Dec. 25, 1962. Filed Feb. 11, 1960.

Attempts are made to improve the thermal, mechanical, and compositional stability, as well as the electrical performance, of a thermoelectric generator. The particular generator involved is a static device for converting heat to direct current electricity without the use of moving parts. The individual thermocouple arms in the generator are encapsulated so that all surfaces of the thermoelectric materials are sealed. Encapsulated arms are produced which form generator pairs with superior stability. (R.J.S.)

8314 WELL LOGGING RADIATION SOURCES. Robert E. Fearon and Jean M. Thayer (to Well Surveys, Inc.). U. S. Patent 3,071,690. Jan. 1, 1963. Filed July 30, 1949.

A well logging method is given for detecting petroleum in subsurface formations. The method comprises irradiating the formations with fast neutrons and measuring the intensity of neutrons rebounding from the formations. Several embodiments of a fast neutron source utilizing the deuteron-triton reaction are described. (D.L.C.)

8315 TELETHERAPY DEVICE. Robert L. Guentner and Edward F. Moran (to Westinghouse Electric Corporation). U. S. Patent 3,073,960. Jan. 15, 1963. Filed July 14, 1958.

A shielded radiation source holder is designed which enables the size and pattern of the radiation beam to be regulated in a simple and facile manner. The holder comprises a rotatable shielded body having a cavity for containing a source capsule and a radially extending aperture for registry with the cavity, and a plurality of collimator cones encircling the body. The cones are rotatable for selection of a particular cone to be registered with the aperture. The holder also has a central guideway along which the source may be moved from a nonoperative position to an operative position within the cone assembly. (D.L.C.)

8316 PARTICLE SEPARATION METHOD. N. G. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 3,075,694. Jan. 29, 1963.

An improved method of sedimentation is described. A series of spaced surfaces of powdered material positioned normal to the centrifugal field concentrates the larger, slower moving molecules of a liquid and hastens sedimentation. (AEC)

Heat Transfer and Fluid Flow

Refer also to abstracts 9849, 9910, and 10016.

8317 (62GL127) THE ONSET OF DROPLET ENTRAINMENT IN ANNULAR GAS-LIQUID FLOW. G. B. Wallis (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Aug. 1962. 33p.

Experiments are reported in which droplet entrainment was measured for co-current flow of air-water mixtures in tubes. It was found possible to define a critical air velocity above which entrainment of droplets occurred. Seven tube diameters were tested as well as the effects of tube length, orientation, inlet design, sampling techniques, and liquid flow rate. The critical air velocity was found to be a weak function of liquid flow rate and to increase with a decrease in pipe size. A Weber Number criterion based on tube diameter, gas velocity, and density, is suggested as a possible transition criterion but further work is required in order to determine over what range of fluid properties and system variables this formulation may be valid. (auth)

8318 (62GL130) GENERAL CORRELATIONS FOR THE RISE VELOCITY OF CYLINDRICAL BUBBLES IN VERTICAL TUBES. G. B. Wallis (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Aug. 1962. 17p.

The rise velocity of cylindrical bubbles in vertical tubes is expressed as a function of the tube diameter, liquid density, viscosity and surface tension, and gravitational acceleration. The resulting correlations are valid for any values of these variables as long as the fluid is Newtonian and the gas density and viscosity are negligible in comparison with the corresponding liquid properties. (auth)

8319 (ANL-6645) ANALOG COMPUTATION OF TEMPERATURE DISTRIBUTION IN SOLIDS WITH ELECTRICAL HEAT-GENERATION AND TEMPERATURE-DEPENDENT PROPERTIES. Darrel G. Harden and Lawrence T. Bryant (Argonne National Lab., Ill.). Nov. 1962. Contract W-31-109-eng-38. 17p.

A problem which frequently arises in experimental heat transfer work is that of determining the surface temperature of a tube in which heat is generated electrically. Solution of this problem involves a temperature measurement of the opposite surface to which a correction factor, the temperature drop through the tube wall, must be applied. This temperature drop is obtained through the solution of the differential equation governing the temperature distribution in the tube wall; however, in the case of temperature-dependent properties of thermal conductivity and electrical resistivity, the governing equation is nonlinear, which necessitates special solutions. In this study a hypothetical surface-temperature problem was established, and the solution of the governing nonlinear differential equation was accomplished by means of an electronic analog computer. Assuming variable properties, the example used in this study was that of a one-dimensional steady-state heat flow through both a thick- and a thin-walled tube. (auth)

8320 (BNL-6046) EDDY TRANSPORT IN LIQUID-METAL HEAT TRANSFER. O. E. Dwyer (Brookhaven National Lab., Upton, N. Y.). Feb. 18, 1962. Contract [AT(30-2)-Gen-16]. 55p.

There are certain semi-empirical equations for estimating heat transfer coefficients for liquid metals flowing through regular shapes. These contain the factor $\bar{\psi}$, which is the average, effective value of the ratio of the eddy diffusivity of heat transfer to that for momentum transfer. The main problem in liquid metal heat transfer has been to evaluate this quantity. It is here proposed that this be done by an equation of the type $\bar{\psi} = 1 - [(a/Pr) - c/(\epsilon_M/\nu)^m_{max}]$. There are insufficient experimental results available to evaluate all three constants, but there is good reason to believe that c is small compared to the a/Pr term and can be neglected. On this basis, it is recommended that a equal 1.82 and m, 1.4. With these constants, the above equation is found to give values of $\bar{\psi}$, which, when incorporated in the semi-empirical equations for estimating liquid-metal heat transfer coefficients, bring theoretical predictions and experimental results into good agreement for flow through circular tubes, concentric annuli, and rod bundles. (auth)

8321 (BNL-6173) EQUATIONS FOR BILATERAL HEAT TRANSFER TO FLUIDS FLOWING IN CONCENTRIC ANNULI. O. E. Dwyer (Brookhaven National Lab., Upton, N. Y.). Apr. 10, 1962. Contract [AT(30-2)-Gen-16]. 24p.

Theoretical equations were derived for calculating heat transfer coefficients for fluids flowing through concentric annuli for the following two cases: (A) constant and equal heat fluxes from both walls, and (B) constant, but unequal, heat fluxes from the walls, with equal wall temperatures at a given axial position along annular channel. In the derivations, the conditions of fully-established flow, and independence of physical properties with temperature variation across the flow channel, were assumed. The only geometrical parameter in this general case is the radius ratio r_2/r_1, and in the study it was varied from 1.0 to 10.0. (auth)

8322 (GEAP-4086) TWO-PHASE PRESSURE LOSSES SECOND QUARTERLY PROGRESS REPORT, MAY 12–AUGUST 12, 1962. E. Janssen and J. A. Kervinen (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Sept. 12, 1962. Contract AT(04-3)-189. 23p.

The pressure drop along a $\frac{1}{2}'' \times 1\frac{3}{4}''$ channel in the horizontal orientation was measured under single and two-phase flow conditions at 600 and 1000 psia. The flow was varied from 0.25×10^6 to 2.0×10^6 lb/hr ft^2, and the quality, from zero to 95%. The single-phase friction factor lies about 20% below the Moody smooth pipe curve. The two-phase friction, both 600 and 1000 psi, agrees with the Martinelli correlation at 40 per cent quality. At qualities below 40%, the points lie generally below the Martinelli curve, while at qualities above 40%, the points lie above. In the quality range where there are data at more than one flow, there is no discernible flow effect. (auth)

8323 (K-1535) A SIMPLIFIED MODEL FOR THE AXIAL FLOW IN A LONG COUNTERCURRENT GAS CENTRIFUGE. A. S. Berman (Oak Ridge Gaseous Diffusion Plant, Tenn.). Jan. 25, 1963. Contract W-7405-eng-26. 23p.

A model is proposed to describe the flow in a long countercurrent gas centrifuge. The model provides for a central feed tube and a radial temperature gradient. Since the ends of the centrifuge and, hence, the actual driving forces for the internal flow are ignored, a term is included in the equations of motion to provide a driving force whenever a thermal gradient is present. The solutions to the simplified equations of motion and energy with the appropriate boundary conditions lead to a description of the radial variation of density, temperature, and axial velocity. (auth)

8324 (TID-11603) HEAT-TRANSFER EXPERIMENTS ON A PROPOSED FUEL ASSEMBLY FOR THE EXPERIMENTAL GAS COOLED REACTOR. SECTION II OF FUEL-ASSEMBLY HEAT-TRANSFER AND CHANNEL PRESSURE-DROP EXPERIMENT FOR THE EGCR RESEARCH AND DEVELOPMENT PROGRAM. C. L. Beaudoin and R. M. Higgins (Allis-Chalmers Mfg. Co. Atomic Energy Div., Washington, D. C.). Apr. 12, 1960. For Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif. Contract AT(10-1)-925. 169p. (RD-0008)

Heat-transfer data are presented for the Experimental Gas Cooled Reactor Title I seven-rod fuel-assembly design. The effect on heat transfer of (1) the radial location of the outer six rods of the seven-fuel-rod cluster and of (2) the addition of helical-finned spacers at the midpoint of each of the seven fuel rods is discussed. The heat-transfer data were obtained to verify preliminary general assumptions pertaining to the heat-transfer characteristics of the seven-rod fuel-assembly design and to obtain local heat-transfer correlations. The heat-transfer tests were performed at near-atmospheric pressure using air as the coolant medium. Plots and equations of heat-transfer correlations over a Reynolds Number range from 12,000 to 60,000 are included. The test set-up and test procedure are also described. (auth)

8325 (TID-15556) THE TRANSIENT BEHAVIOR OF TWO-PHASE NATURAL CIRCULATION SYSTEMS. R. P. Anderson, J. F. Marchaterre, L. Bryant, and J. C. Carter (Argonne National Lab., Ill.). Feb. 1962. Contract W-31-109-eng-38. 13p. (UAC-6161)

The design of high-performance natural-circulation boiling systems requires that the behavior of these systems under transient conditions be characterized. To do this the time and space dependent continuity, energy, and momentum equations for a natural circulation system were written and the resulting set of equations solved simultaneously utilizing an analog computer. A set of criteria that the analytical model must satisfy was set up. These criteria are: the model must perform an accurate steady state calculation of recirculation rate and vapor volume fraction; the model must describe the transient experimental behavior during varying power inputs; and the model must accurately predict the inception of oscillations in the natural circulation system. The resulting equations were compared with experimental results at two pressures and two geometries and met the established criteria. The results were found to be very sensitive to the velocity ratio used in the computation. The velocity ratio correlation used in the model is presented. The model is useful for predicting the behavior of two-phase natural circulation systems during transients and for investigating the point at which such systems exhibit oscillatory behavior. (auth)

8326 (TID-17525) RESEARCH ON HEAT TRANSFER TO FLUIDS FLOWING THROUGH NON-CIRCULAR CHANNELS. Progress Report. E. R. G. Eckert and J. L. Novotny (Minnesota. Univ., Minneapolis. Heat Transfer Lab.). Dec. 1962. Contract [AT(11-1)-659]. 14p.

Experimental turbulent heat transfer studies were made in rectangular ducts with two heated and two unheated walls and in a 10:1 rectangular duct with four heated walls. An analytical study of turbulent heat transfer was made in a parallel plate duct with uniform heat flux, and an analytical study of laminar heat transfer was made in a parallel plate duct with internal heat generation in the fluid. The two boundary conditions investigated were uniform peripheral and axial heat flux and wall temperature. (R.J.S.)

8327 (TID-17538) BASIC EXPERIMENTAL STUDIES OF BOILING FLUID FLOW AND HEAT TRANSFER AT ELEVATED PRESSURES. Monthly Progress Report, November 1962. Bruce Matzner (Columbia Univ., New York. Engineering Research Labs.). Nov. 30, 1962. Contract AT(30-3)-187. 10p. (MPR-XIII-11-62)

An evaluation is presented of 53 instrumented burnout runs and one intentional physical burnout run. These data indicate that the addition of ribs to the outer (annular) channel of the Tubular Test Section results in a reduction of the average burnout heat transfer limits for the assembly. This is due to the fact that the ribs cause a flow reduction in the outer channel where the burnout probably originates. Comparison of the calculated burnout heat fluxes for only the ribbed and unribbed outer channels shows that any variation was well within experimental accuracy of the data. These tests also confirmed recent studies which indicated that for large internally heated annuli the reverse mass velocity effect extends a considerable distance into the subcooled region. In order to assure the same flow split as the HWCTR UO_2 fuel tube and hence establish its correct burnout limits, the Composite Tubular Test Section is being fabricated to simulate inlet and exit configurations in addition to the heater tube dimensions. In this test section separate burnout indications will be obtained from both the inner and outer channels. (auth)

8328 (TID-17702) BASIC EXPERIMENTAL STUDIES OF BOILING FLUID FLOW AND HEAT TRANSFER AT ELEVATED PRESSURES. Monthly Progress Report, December 1962. Bruce Matzner (Columbia Univ., New York. Engineering Research Labs.). Dec. 28, 1962. Contract AT(30-3)-187. 22p. (MPR-XIII-12-62)

Twenty-four instrumented burnout points and one intentional physical burnout run are reported for a composite tubular geometry (inner heater tube ID = 1.478 in. outer heater tube OD = 2.065 in., housing tube ID = 2.90 in. and heated length = 77 in.) with vertical upflow of boiling water at 1000 psia. The ranges of variables studied were: average mass velocities from 0.5 to 2.0×10^6 lb/hr-ft^2, average exit conditions from 14°F subcooled to 29% steam quality and average instrumented burnout heat fluxes as high as 0.96×10^6 Btu/hr-ft^2. As in previous burnout tests with the tubular geometry a very strong reverse mass velocity effect was observed in the data. Contrary to the expected performance in all cases burnout was reached first in the inner channel. At low total flow rates (less than about 50 GPM) and high heat fluxes (above approximately 600,000 Btu/hr-ft^2) a region of test section pressure fluctuations was abruptly encountered during several runs. The transition in and out of this region appeared to follow a line of zero average exit quality. (auth)

8329 (TID-17783) LOW HEAT-FLUX BOILING. Fourth and Fifth Quarterly Progress Reports for the Period April 1, 1962 to October 1, 1962. John A. Clark, Herman Merte, Jr., and Edward R. Lady (Michigan. Univ., Ann Arbor. Coll. of Engineering). Dec. 1962. Contract AT(30-1)-260. 15p. (ORA-04653-4-P)

Progress made in the construction of an experimental system to study boiling of water from the outer surface of tubes at low values of heat flux (from 5000 to 100,000 Btu/hr ft^2) and pressures up to 2000 psia for both natural and forced convection is described. All major system components were installed. As of October 1, 1962, the system was ready for cleaning and preliminary tests. (auth)

8330 (WCAP-1997(Rev.)) NEW DNB (BURNOUT) CORRELATIONS. L. S. Tong, H. B. Currin, and A. G. Thorp, II (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). Sept. 1962. 29p.

The DNB (departure from nucleate boiling) was correlated empirically by using the macroscopic system variables and operational parameters with emphasis on the application to a flow parallel to rod bundles. Results are presented in graphs and tables. (M.C.G.)

8331 (EURAEC-386) IMPROVEMENT OF HEAT-TRANSFER IN NUCLEAR REACTORS WITH BOILING WATER. Quarterly Report No. 9. (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation. Division Atomiques, Suresnes, France). July 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-7-DF. 19p. A translation.

Results are presented for hydrodynamic tests on assembly fractions, low-pressure thermal tests, and high-pressure thermal tests. Flow analyses and pressure drop measurements were made. Graphs and tables are included. (M.C.G.)

8332 TRANSIENT TEMPERATURE VARIATION IN A THERMALLY ORTHOTROPIC PLATE. W. H. Giedt (Univ. of California, Berkeley) and D. R. Hornbaker. ARS (Am. Rocket Soc.) J., 32: 1902-9(Dec. 1962). (UCRL-13043 (Rev.))

A solution is obtained for the two-dimensional transient temperature variation in a thermally orthotropic plate that is subjected to an arbitrary heating rate distribution along one face with all other surfaces insulated. Dimensionless temperature histories and distributions determined from this solution are presented for the representative case of a linearly varying heating-rate distribution along plates with varying degrees of thermal orthotropy. The results establish quantitatively the value of a material with high planar and low normal thermal conductivities for applications where it is desired to maintain minimum temperatures on the rear or unheated surface of a heat shield when the heated surface is subjected to a very nonuniform heating-rate distribution. Transient temperature measurements in a pyrolytic graphite plate heated by an oxyacetylene flame are made to verify the analytical results. Comparison of the predicted and experimental temperature distributions along and through the plate shows agreement to within 10% in the 1200 to 1600°F range and to within 25% the 400 to 500°F level. This agreement is considered satisfactory in view of the strong dependence of the thermal properties of this material on temperature and possible variations in the heating-rate distribution. (auth)

8333 GENERALIZATION OF HEAT TRANSFER DATA IN LIQUID METALS. P. L. Kirillov. At. Energ. (USSR), 13: 481-4(Nov. 1962). (In Russian)

Reliable heat transfer data in liquid metals may be obtained only by temperature measurements within the liquid. On the basis of published data on temperature measurements in turbulently flowing liquid metals, such as Hg, Na, NaK alloy, and Pb–Bi alloy, certain general conclusions may be drawn. Results of these calculations are tabulated; similar values were obtained within a divergence of 8% by a formula which was found to be valid in the Pectet number (Pe) range from 100 to 20000: $Nu = 5 + 0.25\ Pe^{0.8}$, where Nu designates the Nusselt number. However, the formula does not apply to boundary transition to the Laminar region where Nu must be equal to 4.3. In re-calculation of the data in Nu = f(Pe*) coordinates by the least square method the following formula was obtained: $Nu = 4.36 + 0.343\ Pe^{*0.8}$ which is valid with an average derivation of ±2%. This formula may be used to Pe* numbers up to 1000, excluding the Laminar region where Nu = 4.36. (TTT)

8334 HEAT TRANSFER COEFFICIENT AND TEMPERATURE GRADIENTS IN FLUIDISED BEDS. P. T. Blacker and D. R. McLain (Atomic Energy Establishment, Winfrith, Eng.). Chem. Process Eng., 43: 630-3(Dec. 1962).

The objects of the experiments were to choose suitable particulate materials for a fluidized-bed cooler, to test a deep fluidized bed for uniformity of heat transfer coefficient, and to explore the temperature distribution in a centrally heated annular fluidized bed. The techniques used and some of the practical aspects involved, together with the results obtained, are discussed. Mathematical correlation of the results has not been attempted since some of the properties of the bed material were not known. (R.J.S.)

8335 TEST RIG INSTRUMENTATION—4 HEAT TRANSFER TESTS. J. A. Fryer and B. Savage (United Power Co. Ltd., Eng.). Nucl. Power, 7: 64-7(Dec. 1962).

Studies of a fuel element's heat transfer characteristics necessitate measurements of variation of heat transfer and coolant pressure drop coefficients over a range of flows, temperatures, and rates of heat transfer. Equipment used as well as accuracy requirements are discussed, and diagrams of the apparatus are provided. (D.C.W.)

8336 DIGITAL MONITOR CHECKS REACTOR-FLOW RATIOS. Helmar Schlein (Atomics International, Canoga Park, Calif.). Nucleonics, 21: No. 1, 70-1(Jan. 1963).

Circuitry and logical design of the triggering system of a digital computer that monitors the ratio of sodium flow in the primary loop to sodium flow in the secondary loop as part of the protective system of the Hallam Nuclear Power Facility are discussed. (D.C.W.)

8337 ALKALI METAL TWO PHASE HEAT TRANSFER FOR SPACE POWER— PRESENT STATUS. R. D. Brooks and S. G. Sawochka (General Electric Co., Cincinnati). ARS Preprint No. 2547-62. New York, American Rocket Society, 1962. Prepublication Copy. 27p. $1.00.

An investigation is made of two-phase heat transfer and fluid flow characteristics in alkali metals. The theory and experimental data related to boiling and condensing are reviewed. Nucleate boiling data obtained in flat-plate pool boiling experiments for potassium are correlated with several relationships. A model for film boiling based upon the Prandtl mixing length concept is derived. Forced-convection boiling data in tubes are obtained, and both nucleate and film boiling are observed. Heat fluxes up to 600,000 Btu/hr ft^2 are achieved in stable, nucleate boiling. Data for condensation of potassium is also presented. Both forced and natural convection results show poor agreement with the Nusselt condensing correlation. Possible mechanisms for this discrepancy are postulated, and an empirical relation of results is presented. Flow stability for two-phase flow is briefly discussed. Analogy methods of analysis using water are noted. Typical instability observations for a boiling liquid metal loop are presented and the method of correction indicated. (auth)

8338 FIRST-ORDER PERTURBATIONS OF LAMINAR FREE-CONVECTION BOUNDARY LAYERS ON A VERTICAL PLATE. Kwang-Tzu Yang and Edward W. Jerger (Univ. of Notre Dame, Ind.). Preprint Paper No. 62-WA-187. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

A perturbation analysis for laminar free convection along a vertical plate, utilizing the classical boundary-layer solution as the zeroth-order approximation, is presented.

First-order perturbations for the velocity and temperature fields are calculated in detail for Prandtl numbers of 0.72 and 10.0. The propagation of leading-edge singularity into the first-order perturbations is examined and discussed. Good agreement is found between the present solution and experimental data. (auth)

8339 LAMINAR HEAT TRANSFER IN A CHANNEL WITH UNSTEADY FLOW AND WALL HEATING VARYING WITH POSITION AND TIME. R. Siegel and M. Perlmutter (National Aeronautics and Space Administration, Cleveland). Preprint Paper No. 62-WA-113. New York, The American Society of Mechanical Engineers, 1962. 7p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

An analysis is made of incompressible laminar force convection heat transfer between two parallel plates that have a specified heat production to be dissipated at their surfaces. The heat production can vary in an arbitrary manner with time and position along the channel, starting from an initially isothermal condition. The fluid velocity is assumed constant over the channel cross section, but can vary with time. The variation of fluid temperature over the channel cross section is accounted for. General relations are presented in closed form and their application is illustrated by carrying out some typical examples. The results are compared with previous analyses that have assumed constant temperatures over the channel cross section and a constant heat-transfer coefficient. (auth)

8340 INTERACTION OF HEAT TRANSFER BY CONDUCTION, CONVECTION, AND RADIATION IN A RADIATING FLUID. R. Viskanta (Argonne National Lab., Ill.). Preprint Paper No. 62-WA-189. New York, The American Society of Mechanical Engineers, 1962. 11p. (TID-16649)

Paper from Winter Annual Meeting, New York, Nov. 1962.

Consideration is given to the interaction of conduction, convection, and radiation in a fully developed laminar flow. The flat duct consists of two diffuse, nonblack, isothermal parallel surfaces a finite distance apart; the fluid between them emits and absorbs thermal radiation. The problem is formulated in terms of a nonlinear integro-differential equation, and the solution is obtained by a method employed by Barbier. Numerical examples show the influence of the system parameters such as the optical thickness, the ratio which determines the relative role of energy transport by conduction to that by radiation, the emissivity of the duct walls as well as the differences between heating and cooling on the temperature variations across the duct and on the heat-transfer characteristics. Two methods for obtaining approximate temperature distributions for optically transparent and opaque radiating media are outlined and the results discussed. (auth)

8341 FREE CONVECTIVE HEAT TRANSFER TO SUPERCRITICAL WATER EXPERIMENTAL MEASUREMENTS. C. A. Fritsch (Bell Telephone Labs., Whippany, N. J.) and R. J. Grosh. Preprint Paper No. 62-WA-138. New York, The American Society of Mechanical Engineers, 1962. 5p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Laminar free convective heat transfer from a vertical plate was studied for water close to its critical point where there are marked variations in density and specific heat. All of the trends indicated in the previous analytical investigation were verified by the experimental data. There was a systematic deviation of about 20 percent — the analytical results being consistently lower than the experimental observations. However, this could easily be due to the lack of precise thermal conductivity and dynamic viscosity data for the region of interest. This investigation established that the basic conservation and state equations with variable properties may be used to adequately describe laminar free convection heat transfer in supercritical water up to a few tenths of a degree from the critical point. (auth)

8342 LAMINAR FLOW HEAT TRANSFER TO A GAS WITH LARGE TEMPERATURE DIFFERENCES. W. M. Kays (Stanford Univ., Calif.) and W. B. Nicoll. Preprint Paper No. 62-WA-117. New York, The American Society of Mechanical Engineers, 1962. 10p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Results are reported of three experiments on laminar gas flow heat transfer with moderately large temperature differences. The cases considered are laminar flow inside a circular tube with heating, with cooling, and flow normal to a circular tube with heating. All experiments were performed with air. Temperature ratios up to 1.9 were used in the experiments with flow inside a circular tube, and up to 3.0 in the flow normal to a circular tube experiment. In the laminar internal flow experiments it was found that the constant property thermal entry length solutions of Sellars, Tribus, and Klein; and Siegel, Sparrow, and Hallman are accurately applicable to a gas with temperature ratios up to 1.9 if all fluid properties are evaluated at local mixed mean temperature. For flow normal to a circular tube with heating, the constant property experimental correlations appear to be applicable to gas flow for temperature ratios up to 3.0 if fluid properties are evaluated at free stream temperature. (auth)

8343 BUBBLE BOUNDARY LAYER AND TEMPERATURE PROFILES FOR FORCED CONVECTION BOILING IN CHANNEL FLOW. L. M. Jiji (New York Univ., New York) and J. A. Clark. Preprint Paper No. 62-WA-141. New York, The American Society of Mechanical Engineers, 1962. 9p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

The inception of bubbles for forced convection flow over a heated plate in a pressurized channel and their consequent mutual interaction in the formation of a "bubble boundary layer" were investigated. A high pressure closed loop was designed to permit photographic study of boiling over the heated plate and to provide for the measurements of temperature profiles in the boiling fluid. The plate, which is 0.50 in. by 0.48 in., was vertically oriented in a rectangular channel 0.50 in. by 0.46 in. in cross section. Photographs and temperature profile measurements were obtained for forced convection boiling of distilled and degassed water at pressures of 200 to 1000 psia, velocities of 1 to 6 ft/sec, subcooling of 50 to 300°F. Experimental data on the bubble boundary-layer thickness were correlated to within ±20 percent by a single equation covering the range of variables investigated. (auth)

8344 NATURAL CONVECTION FLOWS IN PARALLEL-CHANNEL SYSTEMS. J. C. Chato (Massachusetts Inst. of Tech., Cambridge). Preprint Paper No. 62-WA-169. New York, The American Society of Mechanical Engineers, 1962. 7p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

An analysis was developed for natural circulation flows in vertical multiple-channel systems with nonuniform heat inputs. A three-channel configuration was investigated in detail both analytically and experimentally. The results

showed the existence of a metastable regime in which two metastable flow patterns could occur for a given set of heat input rates. A third predicted flow pattern in this regime was shown to be unstable and, therefore, nonexistent in practice. (auth)

8345 CONDENSATION OF METAL VAPORS DURING RAPID EXPANSION. P. G. Hill, H. Witting, and E. P. Demetri (Northern Research and Engineering Corp., Cambridge, Mass.). Preprint Paper No. 62-WA-123. New York, The American Society of Mechanical Engineers, 1962. 12p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

A study was made of the condensation of metal vapors in nozzles, using the liquid drop nucleation theory, to predict the incidence of condensation and its effect on the properties of the fluid stream. The theory, which has been verified by accurate experimental data on steam, predicts that in the absence of charged particles, initially saturated mercury vapor, for example, is very reluctant to condense in a nozzle. On the other hand, the vapors of sodium, potassium, and rubidium should condense very readily. In each case the typical size and growth rate of the condensed drops are so small that significant slip between vapor and liquid phases is very unlikely to develop. The nucleation process is rapid so that equilibrium is approached quickly. In reasonably long nozzles it may be quite in order to idealize the transition between supersaturated and equilibrium states as a step change. (auth)

8346 FILM BOILING OF STEAM–WATER MIXTURES IN ANNULAR FLOW AT 800, 1100, AND 1400 Psi. E. E. Polomik (General Electric Co., San Jose, Calif.), S. Levy, and S. G. Sawochka. Preprint Paper No. 62-WA-136. New York, The American Society of Mechanical Engineers, 1962. 7p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Film boiling heat-transfer coefficients, beyond "burnout," of 800 to 2000 Btu/hr ft^2 deg F were measured with steam–water mixtures in annular flow at pressures of 800, 1100, and 1400 psi with heater temperatures not exceeding 1000°F. Variation of coefficients with pressure, mass velocity, and steam quality are presented together with a correlation in the range of parameters studied. (auth)

8347 ANALYSIS OF THE CRITICAL HEAT-FLUX CONDITION IN HIGH-PRESSURE BOILING WATER FLOWS. F. E. Tippets (General Electric Co., San Jose, Calif.). Preprint Paper No. 62-WA-161. New York, The American Society of Mechanical Engineers, 1962. 11p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Based on the two-phase flow patterns shown in high-speed motion pictures of the process, a general working equation is derived which relates the critical heat flux for high-pressure bulk boiling water in forced convection to the significant local flow parameters and fluid properties. The equation is applied to a representative selection of several hundred data points from the major available sources for the purpose of investigating trends in the data and to test the validity of the equation. (auth)

8348 CRITICAL HEAT FLUXES AND FLOW PATTERNS IN HIGH-PRESSURE BOILING WATER FLOWS. F. E. Tippets (General Electric Co., San Jose, Calif.). Preprint Paper No. 62-WA-162. New York, The American Society of Mechanical Engineers, 1962. 11p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

High-speed motion pictures (4300 pictures/sec) of boiling water flow patterns in conditions of forced flow at 1000 psia pressure in a vertical heated rectangular channel were taken over the range of mass velocities from 50 to 400 lb/sec-ft^2, fluid states from bulk subcooled liquid flow to bulk boiling flow at 0.66 steam quality, and heat fluxes up to and including the critical heat flux level. Eighty critical heat flux determinations were made in the course of the experiment at 1000 psia in conditions of bulk boiling. The motion pictures provide photographic evidence of the general arrangement of the flow in conditions of bulk boiling at high pressure with heat fluxes near and including the critical heat flux level. (auth)

8349 EFFECT OF WALL ELECTRICAL CONDUCTANCE ON MAGNETOHYDRODYNAMIC HEAT TRANSFER IN A CHANNEL. J. T. Yen (North Carolina State Coll., Raleigh). Preprint Paper No. 62-WA-171. New York, The American Society of Mechanical Engineers, 1962. 7p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Effect of wall electrical conductance on laminar fully developed magnetohydrodynamic heat transfer in a channel with constant wall heat flux and exact magnetohydrodynamic boundary conditions are investigated. For channels with insulated walls, viscous dissipation is more important than joule heating for all Ec (Eckert number) and M (Hartmann number). For sufficiently large wall conductance, viscous dissipation is dominated by joule heating for all Ec, if M is large enough; both are in turn dominated by wall heat flux if Ec is large enough for all M. These and other conclusions are discussed. (auth)

8350 THE TRANSITION FROM SLUG TO HOMOGENEOUS TWO-PHASE FLOWS. R. Moissis (Massachusetts Inst. of Tech., Cambridge). Preprint Paper No. 62-WA-115. New York, The American Society of Mechanical Engineers, 1962. 5p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

An analysis is presented which describes and predicts the process of transition from the nonhomogeneous slug to the homogeneous fog or frothy flow regime in the flow of two-phase mixtures in vertical pipes. The results compare favorably with existing visual flow regime studies. (auth)

8351 HEAT TRANSFER BETWEEN A GAS AND A SPHERICAL SURFACE WITH THE COMBINED ACTION OF FREE AND FORCED CONVECTION. L. S. Klyachko (All-Union Research Inst. of Hydrotechnical and Sanitary-technical Works, USSR). Preprint Paper No. 62-WA-114. New York, The American Society of Mechanical Engineers, 1962. 3p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

The critical analysis of Yuge's work on heat transfer between a gas and a spherical surface is carried out and refined calculation formulas are given in a criterion form. (auth)

8352 CRITICAL HEAT FLUX FOR SUBCOOLED WATER FLOWING NORMAL TO A CYLINDER. G. C. Vliet and G. Leppert (Stanford Univ., Calif.). Preprint Paper No. 62-WA-174. New York, The American Society of Mechanical Engineers, 1962. 7p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Empirical data are presented which show the effects of diameter, water velocity, and subcooling on the critical heat flux from an electrically heated, cylindrical tube or

wire. The maximum flux which can be accommodated in subcooled nucleate boiling is found to vary directly with the water velocity and subcooling and inversely with a fractional power of the heater diameter. The exponent which describes the diameter dependence is itself a function of both velocity and subcooling. Measurements of the critical flux are reported for water at atmospheric pressure over a range of subcooling from 3 to 100°F, velocity from 0.5 to 11 ft/sec, and heater diameter from 0.010 to 0.189 in. Visual and photographic observations indicate a marked effect of subcooling on the flow mechanism near the critical heat flux. High subcooling prevents the formation of the vapor cavity which was described in the previous paper for nearly saturated water, although the failure of nucleate boiling still occurs at the rear of the cylinder and is accompanied by a concentration of vapor in that region. (auth)

8353 CRITICAL HEAT FLUX FOR NEARLY SATURATED WATER FLOWING NORMAL TO A CYLINDER. G. C. Vliet and G. Leppert (Stanford Univ., Calif.). Preprint Paper No. 62-WA-173. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Visual and photographic observations are used to construct a physical model of the mechanism of transition from nucleate to film boiling on a cylindrical heater. Interest is focused on forced-convection boiling of a liquid which is near its saturation temperature. An approximate analysis is presented of the saturated nucleate-boiling model which predicts the critical flux, and comparisons are made with experimental observations. Measurements of the peak nucleate-boiling heat flux are reported for water at atmospheric pressure over a velocity range of 1.2 to 9.5 feet per second. Resistively heated, stainless steel wires and tubes of 0.010 to 0.189-inch diameter, the latter with wall thicknesses of 0.006 to 0.028 in., were used. Within these ranges of variables, the critical flux is found to increase with the square root of the velocity and to be independent of heater wall thickness. Only a weak dependence on the heater diameter is observable, but the tendency is for the peak flux to diminish for larger tubes. (auth)

8354 VISCOUS FLUID FLOW UNDER THE INFLUENCE OF A RESONANT ACOUSTIC FIELD. K. R. Purdy, T. W. Jackson, and C. W. Gorton (Georgia Inst. of Tech., Atlanta). Preprint Paper No. 62-WA-116. New York, The American Society of Mechanical Engineers, 1962. 10p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

An analytical solution is presented for laminar channel flow under the influence of a resonant acoustic field. The solution predicts that standing vortices exist in the flow and that the size of these vortices, the ratio of the width of the vortex to the half channel width, is dependent upon the parameter $\overline{M}/M_0^2$ where $\overline{M}$ is the average Mach number of the through flow and M_0 is the acoustic Mach number which is based upon the maximum amplitude of the time dependent velocity. The existence of the standing vortices was confirmed experimentally by a visualization study of tube flow. Typical flow fields are shown photographically. Finally the threshold data of Eastwood for convection heat transfer under the influence of a resonant acoustic field are correlated. It was shown that sound affects the local heat-transfer rate if $\overline{M}/M_0^2$ is less than 63. (auth)

8355 THE THERMAL INSTABILITY OF COMPLETELY CONFINED FLUIDS INSIDE SOME PARTICULAR CONFIGURATIONS. S. Ostrach and D. Pnueli (Case Inst. of Tech., Cleveland). Preprint Paper No. 62-WA-140. New York, The American Society of Mechanical Engineers, 1962. 9p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

The thermal stability of completely confined fluids subject to a body force and a temperature gradient which are parallel and oriented in the same direction was studied. A method is described for obtaining upper bounds to the instability criterion (the critical Rayleigh number) for piecewise cylindrical configurations, and the use of this method treating some particular practical configurations is demonstrated. These upper bounds are shown to coincide with the critical Rayleigh number under some conditions. An account of experimental investigation of three of the particular configurations is presented and the experimental results compare favorably with the computed upper bounds. (auth)

8356 HEAT TRANSFER AND FORCES FOR FREE-MOLECULE FLOW ON A CONCAVE CYLINDRICAL SURFACE. E. M. Sparrow, V. K. Jonsson, T. S. Lundgren, and T. S. Chen (Univ. of Minnesota, Minneapolis). Preprint Paper No. 62-WA-181. New York, The American Society of Mechanical Engineers, 1962. 9p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

An analysis was carried out to determine the local and overall heat-transfer rates, the adiabatic wall temperature, and the forces exerted when a high-speed, free-molecule flow is incident on a concave cylindrical surface. The flow may impinge on the surface at an arbitrary angle of attack. Additionally, the thermal accommodation coefficient may be arbitrary, and the degree of concavity of the surface may be varied at will from a semicircular cross section to a relatively flat circular arc. The concavity causes molecules to interreflect back and forth between surface elements. Even with the interreflections, the heat-transfer rate continues to depend linearly on the difference between the wall temperature and the adiabatic wall temperature. The interreflections are found to have a greater effect on both the heat transfer and the force results as the accommodation coefficient decreases and as the degree of concavity and the angle of attack increase. (auth)

8357 FRICTION AND FORCED CONVECTION HEAT-TRANSFER CHARACTERISTICS IN TUBES WITH TWISTED TAPE SWIRL GENERATORS. E. Smithberg (Newark Coll. of Engineering, N. J.) and F. Landis. Preprint Paper No. 62-WA-176. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Velocity distributions, friction losses, and heat-transfer characteristics were studied analytically and experimentally for fully developed turbulent flow in tubes with twisted tape swirl generators. Data were obtained for pitch-to-diameter ratios from 3.62 to 22.0 with both air and water under isothermal and forced convection heating conditions. The following principal conclusions result: (a) The velocity field is helicoidal and corresponds to a forced vortex in the core superposed on an essentially uniform axial flow. (b) Friction losses may be predicted from the combined effects of the axial and tangential boundary-layer flows coupled with an additional "vortex-mixing" effect. (c) Approximate heat-transfer correlations can be predicted from a Colburn-type analysis. These may be improved by considering a boundary layer and vortex mixing model. (auth)

8358 PRESSURE DROP AND LIQUID FILM THICKNESS OF TWO-PHASE ANNULAR AND ANNULAR-MIST FLOWS. Sze-Foo Chien (Texaco, Inc., Bellaire, Tex.) and

W. Ibele. Preprint Paper No. 62-WA-170. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Measurements of the pressure drop and the film structure for two-phase annular and annular-mist flow are reported and correlations among the important variables are presented. Air and water were used as the gas and liquid phases, respectively. The velocities corresponded to superficial liquid Reynolds numbers of 1250 to 22,000 and superficial gas Reynolds numbers from 28,000 to 350,000. (D.L.C.)

8359 EXPERIMENTAL STUDY OF LAMINAR FLOW HEAT TRANSFER WITH PRESCRIBED WALL HEAT FLUX. R. G. Akins and J. S. Dranoff (Northwestern Univ., Evanston, Ill.). AIChE Preprint 80. New York, American Institute of Chemical Engineers, 1962. Prepublication Copy. 29p. $0.50.

An experimental study of laminar flow heat transfer in a cylindrical tube was made in order to test an analytical method for predicting temperature profiles which has recently appeared in the literature (Katz, S., Chem. Eng. Sci., 10: 202(1959)). The experimental equipment was designed to measure wall temperatures to better than 0.1°C and to utilize small radial heat fluxes so as to minimize effects of natural convection. A series of experiments was carried out using five different types of prescribed wall heat flux with water flowing in a vertical tube. The measured wall temperatures in these experiments compared very well with those predicted by the theoretical solution. Small deviations which did exist were well explained in terms of experimental errors. The good agreement found indicates that the analytical method may be safely used in the analysis of experimental data from such heat transfer problems as well as analogous mass transfer problems. (auth)

8360 CRITICAL HEAT FLUX OF SOME POLYPHENYL COOLANTS. Jerry M. Robinson and Henry Lurie (Atomics International, Canoga Park, Calif.). AIChE Preprint 156. New York, American Institute of Chemical Engineers, 1962. 30p. $0.50.

The critical heat flux (CHF) of Santowax R (a polyphenyl mixture), Santowax R containing diphenyl and/or radiolytic high boilers, and coolant from the Organic Moderated Reactor Experiment (OMRE) was measured as a function of mass velocity, subcooling, and pressure under forced convection, subcooled boiling conditions. The data were correlated by equations of the form $q_c = A + B\,\Delta T_s G^{0.8}$ where q_c = critical heat flux, Btu/hr-ft^2, ΔT_s = subcooling, °F, and G = mass velocity, lb/sec-ft^2. A and B are empirical constants that depend only on the coolant composition. Over the range of variables covered, the critical heat flux data were correlated by: (a) Santowax R, $q_c = 198{,}000 + 14.5\,\Delta T_s G^{0.8}$; (b) a mixture of Santowax R and 27 wt % radiolytic high boilers, $q_c = 353{,}000 + 16.9\,\Delta T_s G^{0.8}$; (c) mixture (b) with diphenyl added to give 2.9 to 7.4 total wt % diphenyl, $q_c = 282{,}000 + 23.0\,\Delta T_s G^{0.8}$; (d) OMRE, Core II coolant, $q_c = 219{,}000 + 29.2\,\Delta T_s G^{0.8}$. At the same subcooling and mass velocity, the critical heat flux increases as a result of adding radiolytic high boilers to Santowax R. For $\Delta T_s G^{0.08} \geq 11{,}000$, the CHF of Santowax R + HB + diphenyl is greater than the CHF of Santowax R + Hb, and that of OMRE coolant is higher than either. (auth)

8361 HEAT TRANSFER AND PRESSURE-DROP PERFORMANCE OF DISTRIBUTED AIRFOIL-SHAPED TUBE SUPPORTS. Henry C. Paulsen, II (General Dynamics Corp., Groton, Conn.). AIChE Preprint 129. New York, American Institute of Chemical Engineers, 1962. Prepublication Copy. 32p. $0.50.

A novel shell-and-tube heat exchanger concept has been developed and tested by General Dynamics/Electric Boat as part of the MGCR contract with the AEC and MarAd. This heat exchanger configuration is based on an array of airfoil-shaped transverse tube-supports distributed along the tube bundle, thereby maintaining shellside flow parallel to the tube, in counterflow, and markedly reducing shellside pressure-drop. Heat exchanger pressure drop is of particular importance in the design of heat exchangers for nuclear gas-turbine plants where compressor power is a major factor. The distributed support concept offers considerable reduction in size, weight, and cost over conventional shell-and-tube exchangers, without comprising stability during transients or complicating manufacture. Helium and air tests were conducted to establish heat transfer and pressure-drop performance of a model heat exchanger over a Reynolds number range from 10,000 to 100,000. Tests were first conducted with no tube supports in the test section to determine the performance datum of the tubes alone, then with the airfoil supports installed. The supports induced a 40 percent boost in heat transfer coefficients and 70 percent increase in the core pressure-drop, compared to unsupported tubes. The results of the unsupported tube tests indicated a value of (2j/f) = 0.91, and the airfoil-supported results gave a value of 0.72. This high value for the airfoil-supported core permits design of compact gas-to-gas shell-and-tube heat exchangers with low pressure drop. (auth)

8362 IMPROVEMENT OF HEAT TRANSFER TO WATER FLOWING IN AN ANNULUS BY ROUGHENING THE HEATED WALLS. William S. Durant, Robert H. Towell, and Samuel Mirshak (E. I. du Pont de Nemours and Co., Aiken, S. C.). AIChE Preprint 128. New York, American Institute of Chemical Engineers, 1962. 22p. $0.50.

Forced convection heat transfer to water flowing in annuli was increased by roughening the heated inner walls with diamond knurls up to 0.025 inch deep. Heat transfer coefficients for the knurled surfaces, together with friction factors for the annular flow, were measured at nonboiling conditions with average fluid velocities of 10 to 30 ft/sec, film temperatures of 35 to 125°C, and equivalent diameters of ¼ to ½ inch. Burnout heat fluxes were also measured for both smooth and knurled surfaces. When compared at the same pumping power, the liquid-film heat transfer coefficients of the knurled annuli were up to 75% higher than those of smooth-walled annuli. The corresponding improvement in burnout heat flux was as much as 60%. (auth)

8363 MEASUREMENT OF LOCAL HEAT TRANSFER COEFFICIENTS FOR FLOW OF HYDROGEN AND HELIUM IN A SMOOTH TUBE AT HIGH SURFACE TO FLUID BULK TEMPERATURE RATIOS. Walter F. Weiland (National Aeronautics and Space Administration, Cleveland). AIChE Preprint 126. Prepublication Copy. 33p. $0.50.

Local values of heat transfer coefficients have been measured experimentally for helium and hydrogen gas flowing through an electrically heated Inconel tube. The experiment was conducted primarily to determine the effect on the heat transfer coefficient of a large density change, radially, in the heat transfer fluid. This large density change was accomplished with relatively high surface temperatures as compared to fluid bulk temperatures or more commonly referred to as high surface-to-fluid-bulk temperature ratio. The large temperature ratio was achieved by precooling the gas with liquid nitrogen. Data

were measured for local values of surface-to-fluid-bulk temperature ratios up to 4.5, Reynolds numbers in the turbulent flow region, surface temperatures up to 2300°R, heat flux up to 1,600,000 Btu/(hr)(ft^2), and length-to-diameter ratio of 250. A comparison of these data with the conventional heat transfer correlation equation (Dittus-Boelter eq.) is shown on a curve of Nusselt number divided by Prandtl number versus the Reynolds number. The gas properties were evaluated at the film temperature and the Reynolds number was modified by evaluating the velocity term at the fluid bulk temperature and the density at the film temperature. (auth)

8364 PREDICTION OF SURGE PRESSURE FROM CHECK VALVES FOR NUCLEAR LOOPS. E. B. Pool (Edward Valves, Inc., East Chicago, Ind.), A. J. Porwit, and J. L. Carlton. ASME Preprint Paper No. 62-WA-219. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 8p. $1.00.

The method of Esleeck and Rosser for predicting surge pressure from operation of any check valve of the pivoting type in any system has been modified to agree with experimental surge measurements so that predictions can be made with greater accuracy. (auth)

8365 MINIMIZATION OF SURGE PRESSURE FROM CHECK VALVES FOR NUCLEAR LOOPS. E. B. Pool (Edward Valves, Inc., East Chicago, Ind.). ASME Preprint Paper No. 62-WA-220. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 8p. $1.00.

Surge pressure analysis, developed and confirmed by experiment in a companion paper, is used to optimize check valve design, particularly for the Indian Point Plant of Consolidated Edison Company. (auth)

8366 THE EFFECT OF APPLIED VOLTAGE ON BOILING HEAT TRANSFER. Michael Markels, Jr. and Robert L. Durfee (Atlantic Research Corp., Alexandria, Va.). AIChE Preprint 157. New York, American Institute of Chemical Engineers, 1962. 29p. $0.50.

Boiling heat transfer to isopropanol from a steam-heated, chrome-plated copper tube 0.375 inches in diameter was increased as much as four times the normal peak heat flux by the application of up to 3,500 volts d-c between the liquid and the tube. The heat transfer coefficient at 3,500 volts and a ΔT of 128°F was 3,120 Btu/(hr)(ft^2·°F). The process completely eliminated film and transitional boiling above 500 volts, and the boiling is nucleate over the entire range of temperature difference covered (40–180°F). This large effect of voltage appears to involve a condenser effect which destabilizes the vapor space between the liquid and the heat transfer surface and is not due to dielectrophoresis in a convergent field. The results obtained substantiate the theories of surface wetting during transitional boiling. (auth)

8367 AN EXPERIMENTAL INVESTIGATION OF FREE-CONVECTION HEAT TRANSFER FROM RECTANGULAR-FIN ARRAYS. K. E. Starner (Aerospace Corp., El Segundo, Calif.) and H. N. McManus, Jr. ASME Preprint Paper No. 62-WA-110. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 5p. $1.00.

Average heat-transfer coefficients are presented for four fin arrays positioned with the base vertical, 45 degrees, and horizontal while dissipating heat to room air. The fins are analyzed as constant-temperature surfaces since the lowest fin efficiency encountered was greater than 98 percent. It was found that coefficients for the vertical arrays fell 10 to 30 percent below those of similarly spaced parallel plates. The 45-degree arrays yielded results 5 to 20 percent below those of the vertical. Two flow patterns were investigated for the horizontal arrays, and it was found that the coefficients could be reduced sharply by preventing three-dimensional flow. (auth)

8368 ON THE PHENOMENON OF BOILING FLOW IN A PARALLEL ROD ARRAY. Neil C. Sher, Glenn J. Kangas, and Kenneth F. Neusen (Allis-Chalmers Mfg. Co., Greendale, Ind.). AIChE Preprint 158. New York, American Institute of Chemical Engineers, 1962. 36p. $0.50.

Low-pressure experiments were undertaken in which water and air-water mixtures were used to study the effects of tube-sheet type spacers on the axial pressure profile. The static pressures immediately behind the spacers indicate that the flow re-establishes itself within two equivalent diameters of the disturbance. Recovery from the disturbance which occurs at the entrance section takes approximately twelve equivalent diameters to be completed. Experiments were performed at 600 psia with mass velocities from 1.0×10^6 to 2.5×10^6 lb/hr-ft^2, and heat fluxes as high as 150,000 Btu/hr-ft^2 to measure the effect of boiling on the frictional and spacer type pressure losses in a 6-ft-long section and to measure the void fraction by a fine γ-ray traversing technique. Results are compared with available correlations for other geometries with generally good agreement. (auth)

8369 DYNAMIC RESPONSE OF HEAT EXCHANGERS TO THE DISTURBANCE OF WALL TEMPERATURE. W. J. Yang (Univ. of Michigan, Ann Arbor). ASME Preprint Paper No. 62-WA-27. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 5p. $1.00.

The dynamic response of a single-duct, single-fluid heat exchanger to the disturbance of wall temperature was investigated. Step, frequency, and ramp-responses of the fluid temperature are analyzed. A phenomenon of resonance in the amplitude-ratio and phase-shift is disclosed for the frequency response. The resonance phenomenon is physically interpreted by analyzing the enthalpy change of the fluid in the heat exchanger. Theoretical analysis is compared with experimental results and qualitative agreement is obtained. Heat exchangers to which these results apply include the double-pipe and shell-and-tube types having negligible wall-capacity lag on the heating side. (auth)

8370 INCIPIENT BOILING IN FORCED-CONVECTION CHANNEL FLOW. L. M. Jiji (New York Univ., New York) and J. A. Clark. ASME Preprint Paper No. 62-WA-202. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 8p. $1.00.

The results of an experimental study of the process of incipient boiling for forced-convection flow of pressurized water past a heated plate are presented. A system was designed for photographic study of boiling from a 0.5 × 9.48-in. plate vertically oriented in a 0.50 × 0.48-in. rectangular channel. Data on the location of initial nucleation were obtained for pressures of 200–1000 psi, subcoolings of 50–300°F and velocities of 1–6 fps. An equation is given which correlates the experimental data for incipient boiling to within ±15 percent. (auth)

8371 TECHNIQUES FOR EVALUATING TEMPERATURE GRADIENTS DURING TRANSIENT HEAT FLOW. T. E. Chappell and J. I. Gonzalez (Martin-Marietta Corp., Baltimore). SAE Preprint 595D. New York, Society of Automotive Engineers, Inc., 1962. Prepublication Copy. 7p. $1.00.

Methods for determining temperature response in both structure (insulative and/or basic) and internal compart-

ments and the use of digital computing programs for obtaining their responses are discussed. The following topics are discussed in detail: (1) heat balance and finite difference solution, (2) material thermophysical properties, (3) thermodynamic and transport properties of boundary layer air, (4) aerodynamic heating, and (5) material ablation. (auth)

8372 FREE CONVECTION AND RADIATION HEAT TRANSFER FROM FIN-ON-TUBE HEAT EXCHANGERS. J. A. Edwards (North Carolina State Coll., Raleigh) and J. B. Chaddock. ASME Preprint Paper No. 62-WA-205. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 11p. $1.00.

A theoretical development of the free convection, radiation, and combined free convection and radiation heat transfer from circular fins, mounted vertically and concentrically on a tube of uniform temperature, is presented. The expression for the free-convection, heat-transfer coefficient is taken from a correlation plot similar to that employed by Elenbaas for vertical flat plates. Exact solutions for the radiation shape factors of the fin are employed in the numerical solution of the differential equations defining the thermal state of the fins. Results are presented as plots of fin efficiency, and compared with extensive experimental measurements on fins constructed of copper, aluminum, steel, and stainless-steel materials. (auth)

8373 STEAM GENERATOR-SUPERHEATER FOR MOLTEN SALT POWER REACTOR. B. W. Kinyon and G. D. Whitman (Oak Ridge National Lab., Tenn.). Am. Soc. Mech. Engrs., Paper No. 61-WA-228(1961).

A bayonet-type steam-generator-superheater unit design for use in molten-salt power-reactor systems is described, and the operational characteristics of this unit and the reactor system are discussed. Curves show typical temperature patterns, both axial and radial. The effect of variations of flow rate and steam-passage hydraulic diameter on tube length, number of tubes, heat flux, and coolant pressure drop is plotted against steam pressure drop, in producing 2000-psia, 1000°F steam. (auth)

8374 HEAT TRANSFER AND SKIN FRICTION FOR TURBULENT BOUNDARY-LAYER FLOW LONGITUDINAL TO A CIRCULAR CYLINDER. E. M. Sparrow, E. R. G. Eckert, and W. J. Minkowycz (Univ. of Minnesota, Minneapolis). ASME Preprint Paper No. 62-WA-7. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 7p. $1.00.

An analysis has been carried out for the turbulent velocity and thermal boundary layers which develop along a cylinder whose axis is parallel to the free-stream flow. Local and average friction factors are calculated as functions of the length Reynolds number Re_x for various cylinder sizes (characterized by the radius Reynolds number Re_{r_0}). For corresponding flow conditions, the friction factor for a cylinder always exceeds that for the flat plate. Local heat-transfer coefficients corresponding to the case of uniform wall heat flux have been obtained for Prandtl numbers of 0.7 and 5. As with the friction factors, the cylinder heat-transfer coefficients exceed those for the flat plate. This effect of the cylindrical geometry on heat transfer diminishes with increasing Prandtl number. (auth)

8375 ANALYSIS OF LAMINAR FULLY DEVELOPED HEAT TRANSFER IN THIN RECTANGULAR CHANNELS WITH FUEL LOADING REMOVED FROM THE CORNERS. Joseph M. Savino, Robert Siegel, and Edward C. Bittner (National Aeronautics and Space Administration, Cleveland). AIChE Preprint 125. New York, American Institute of Chemical Engineers, 1962. Prepublication Copy. 33p. $0.50.

An analysis is presented of convective heat transfer in thin rectangular channels such as are commonly found in nuclear reactor fuel assemblies. The velocity and temperature profiles are both assumed to be fully developed. Heating takes place in the fueled region located on the broad channel sides, but the fuel extends only part way to the corners. The short sides and portions of the broad sides that are not fueled are assumed insulated. The wall temperature distributions are shown to be strongly dependent on the spacing between the heated region and the corners. For uniform heating the maximum wall temperature shifts rapidly from the corner to the center of the broad side as this spacing is increased from zero to only one half the distance between the broad sides. With a cosine heating distribution where the peak flux is at the fuel edges, the wall temperature gradients are more severe than for the uniform heating case. Tables of temperature distributions in the fluid are also given. (auth)

8376 VISCOUS FLOW OF A LIQUID OVER A ROTATING SURFACE WITH GAS DRAG. G. C. Gardner (Central Electricity Generating Board, London). ASME Preprint Paper No. 62-WA-56. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 6p. $1.00.

Differential equations are set up to describe the viscous flow of a liquid on a rotating surface with a shear stress exerted by a flowing gas stream along the surface and normal to the radial direction. Such a problem is met in the low-pressure stages of a steam turbine. The equations are solved first for a uniform flux of liquid onto the surface along a radial boundary $R > R_0$, where R is the radial position and R_0 is constant. It is then shown that absence of liquid flowing in along the radial boundary from $R = R_0$ casts what is called a "flow shadow" and that two solutions of the equations are required, one for the "shadow flow" and one for the "main flow" region. The solutions are extended to the case where the shear stress exerted by the gas varies in a manner described by a simple power function of the distance along the surface, x, normal to the radial direction. All these solutions can be represented on a single graph showing streamlines and the shadow boundary. In conclusion, it is demonstrated that the two solutions for the main and shadow flows are special cases of a more general solution in which flow in along the radial boundary at $x = 0$ varies as $[1 - (R_0/R)^{\frac{1}{2}}]^2$. (auth)

8377 RADIATIVE TRANSFER FROM SOLID MATERIALS. Henry Blau and Heinz Fischer, eds. New York, The Macmillan Company, 1962. 464p. $7.50.

Fourteen papers are included which were presented at a conference in Boston, Mass., on Dec. 12 to 13, 1960. The papers are arranged into sections dealing with the theory of radiative properties of metals and dielectrics, high-temperature emittance, standards for measurement methods, room-temperature emittance and reflectance, and radiation in space. (D.L.C.)

8378 A RADIOTRACER TEST FACILITY FOR HIDEOUT MEASUREMENTS UNDER BOILER CONDITIONS. P. Cohen, G. Russell Taylor, and L. F. Picone (Westinghouse Electric Corp., Pittsburgh). Preprint Paper No. 62-WA-253. New York, The American Society of Mechanical Engineers, 1962. 7p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 25-30, 1962.

The purpose and principle of a radiotracer technique for the in situ measurement of hideout at high temperature and

pressure are discussed and its application to the quantitative observation of sodium phosphate hideout is illustrated. (auth)

8379 TRANSIENT INTERNAL NATURAL CONVECTION HEATING AND COOLING OF CLOSED, VERTICAL, CYLINDRICAL VESSELS. F. G. Hammitt and Paul T. Chu (Univ. of Michigan, Ann Arbor). Preprint Paper No. 62-WA-309. New York, The American Society of Mechanical Engineers, 1962. 12p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 25-30, 1962.

A method is presented for estimating cooling or heating times for fluid-containing vessels which are of a temperature different from the external ambient temperature. The method is of sufficient accuracy in certain cases for most engineering purposes. (auth)

Materials Testing

Refer also to abstracts 9837, 10186, 10187, 10188, 10189, 10190, 10191, 10192, 10193, and 10194.

8380 (ANL-FGF-386) NEUTRON RADIOGRAPHY AS AN INSPECTION TECHNIQUE. Harold Berger (Argonne National Lab., Ill.). Sept. 1962. Contract [W-31-109-eng-38]. 23p. (UAC-6936)

A discussion of techniques used for neutron radiographic inspection is presented. Information is included on neutron sources, neutron image detectors, and on the characteristics of several photographic detection methods. (J.R.D.)

8381 (HW-67639) BROADBAND ELECTROMAGNETIC TESTING METHODS. PART 2. SIGNAL ANALYSIS. H. L. Libby and C. W. Cox (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 1961. Contract AT(45-1)-1350. 35p.

The work of Dr. W. H. Huggins in the field of signal analysis is reviewed as it applies to eddy-current, nondestructive testing. Theory is provided for this approach to signal analysis as it may apply to nondestructive testing. It was concluded that these methods show promise for a breakthrough in the problem of extracting information from the broadband, eddy-current, nondestructive test signals. (auth)

8382 (TID-17434) THERMAL SHOCK ANALYSIS: ANALYTICAL SOLUTION FOR THERMAL SHOCK IN THIN-WALLED CYLINDER. EXPERIMENTAL INVESTIGATION SETUP. Technical Report ME-1. F. D. Ju and R. C. Dove (New Mexico. Univ., Albuquerque. Engineering Experiment Station). July 1960. For Sandia Corp., Albuquerque, N. Mex. Contract [AT(29-1)-789]. 77p. (SCDC-2935).

An investigation was made of transient thermal stresses in thin-walled cylinders due to axial temperature gradients and end restraints. The theoretical solutions yielded results in two groups, namely, the quasi-static and the dynamic cases. The thermal-loading conditions which were investigated were a step-temperature rise, a piecewise linear-temperature-rate variation, and a sinusoidal variation of temperature at one end of a cylinder; and a sudden energizing of a thermal core in a cylinder. The problems involving a temperature rise at one end of a cylinder were assumed to have adiabatic walls, while the thermal core problem dealt with an adiabatic outer wall only. The problem of a step-rise in temperature at one end of a cylinder yielded an upper limit for various thermal shock loads. The piecewise linear-temperature-rate variation approximated actual problems. The sinusoidal variation was designed for the purpose of stability analysis, for which it was found that there exists no critical frequency of temperature variation. The thermal core problem was a simplified analysis of a cooling tube problem with a heat core undergoing a sudden change in the energy level. In the related experimental research, it was resolved to use strain gages mounted with cement for strain measurement in the medium temperature operating range. An experimental investigation is still being conducted on high temperature strain transducers. The experimental model was made of a 4½-in. aluminum pipe. Both walls were insulated with Gustin-Bacon pipe insulation. A copper header, consisting of a heavy collar and a plug, provided the necessary thermal shock load. The thermal strains were recorded on Brush amplifiers and oscillographs. The corresponding temperatures were measured with a cathode-ray-oscilloscope. The recorded strain readings contained factors called apparent strains, which were affected by a difference in the thermal expansion coefficients of the gages and test cylinder, by the change in the resistivity of the gage with temperature and by the temperature rate. This uncontrolled quantity was reproduced on a free-expansion test piece under identical operating conditions. The difference between the two readings yielded the true strains due to thermal stresses. (auth)

8383 (TID-17656) STATISTICS OF MEASUREMENT. Fred H. Tingey (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). [nd]. Contract [AT(10-1)-205]. 46p.

The evaluation of a measurement program for determining constituent compositions for given materials usually goes through three stages. These are: (1) Identification and estimation of measurement error associated with the procedure; (2) Definition of an "optimum" measurement procedure; and (3) Establishment of statistical quality control over the various steps defining the procedure. Some of the more useful statistical techniques are presented which have application to these three problems. (W.D.M.)

8384 DYNAMIC RADIOLOGICAL TESTING METHODS. K. F. Sinclair and H. A. Zagorites (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). ARS (Am. Rocket Soc.) J., 32: 1892-8(Dec. 1962).

The design and performance of dynamic flaw detection systems using x and gamma radiation and scintillation detection are discussed. The basic methods discussed are transmission and backscatter techniques. In the latter method, the information is carried by degraded photons resulting from Compton interaction in the test medium. In the transmission method, the information is contained in the unscattered beam of gamma photons that traverse the test medium. Sensitive radiation detectors, suitably collimated for the resolution required, are used to sense the pertinent radiation. Variations in the number of photons detected per unit time, not attributable to known dimensional changes in the test medium, are indicative of anomalies in the specimen. During inspection, the test medium is either in continuous motion or stepped in some systematic way to provide the coverage desired. Optimum performance can be achieved in a given situation by proper selection of source, collimation, detector, scan speed, and time constant. A simple expression relating these parameters is developed. Results obtained with experimental systems are in agreement with the theoretically predicted performance. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

8385 (A/AC.82/G/L.795) LA RETOMBEE RADIOACTIVE A MOL RAPPORT D'AVANCEMENT 1er SEMESTRE 1961. (Radioactive Fall-Out at Mol. Progress Report for the First Six Months of 1961). R. Boulenger and E. Van der Stricht (Brussels. Centre d'Etude de l'Energie Nucleaire). 48p. (R.2080)

The semi-annual progress report on the fallout measured at Mol is presented. The results of measurements on the radioactivity of the air, the total fallout, the determination of Sr^{90}, the determination of Cs^{137}, and meteorological data are presented in tabular form. (J.S.R.)

8386 (NP-12392) THE RELATION BETWEEN THE RADIOACTIVE FALL-OUT IN AIR AND RAIN. H. H. Ph. Moeken and J. J. H. Alderhout (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium). Feb. 9, 1961. 14p. (ETR-100)

Two models of rain scavenging of atmospheric fall-out are discussed. Coagulation with droplets in the cloud and subsequent rain-out seems relatively more important than direct impact of radioactive particles by rain drops. Based on the coagulation model, a mathematical expression between air and rain activity was deduced. A relation between the air and rain concentration of fall-out at ground level was derived by regression analysis of data measured at Riso during 38 months. This relation is in fairly close agreement with a similar one found by Peirson et al. (auth)

8387 (NP-12426) HARDHAT. Long Range Seismic Measurements [of] VELA UNIFORM Project 8.4. (Air Force Technical Applications Center, Washington, D. C.). Feb. 15, 1962. 39p.

The HARDHAT event was detonated on February 15, 1962, at the Nevada Test Site in granite at a depth of 950 ft. An analysis is presented of the film seismograms obtained from various locations. As a measure of the effectiveness of a network of hypothetical control stations having approximately 10,000 km spacing, a comparison was made between the actual location of the shot and its computed hypocenter. Data are summarized in tables. (M.C.G.)

8388 (NYO-9524) INTERPRETATION OF WESTWOOD, NEW JERSEY RAINFALL DATA. Quarterly Progress Report No. 1. (Isotopes, Inc., Westwood, N. J.). Sept. 15, 1959. Contract AT(30-1)-2415. 44p.

Progress is reported in an evaluation of fission product concentration in rain as a function of time, location, and meteorological setting. Data on rainfall collected at Westwood, N. J., were analyzed for information on the mechanisms of fallout deposition, seasonal variations in fallout, the stratospheric residence time of W^{185} resulting from Operation Hardtack, and the accuracy of pot samplers for sample collection. Data from other collection stations were also analyzed for consistency with Westwood data. (C.H.)

8389 (NYO-10392) STUDY OF TECHNIQUES FOR DETERMINING DISTRIBUTION OF RADIOACTIVE MATERIAL DEPOSITED IN THE UPPER ATMOSPHERE. Quarterly Status Report No. 2, June 20, 1962–September 19, 1962. (Geophysics Corp. of America, Bedford, Mass.). Contract AT(30-1)-2908. 43p.

The derivation of a theoretical model for predicting the spread of material in the upper atmosphere above 100 km and computations with this model are described. This model which considers molecular diffusion and gravitational settling in a constant scale-height atmosphere, can be applied with relatively little modification to the real atmosphere in the 100-400 km region. Two theoretical models for the vertical transfer of material injected into the atmosphere below 100 km are derived. In the first of these models, the main assumptions include constant turbulent diffusion coefficients in the two layers of the model, negligible gravitational affects, and washout at the lower boundary. In the second model the major assumptions include a single, constant turbulent diffusion coefficient, a gravitational settling velocity independent of height, and a quasi-washout condition at the lower boundary. Graphs that permit calculations to be made are presented for both models. However, the restrictive assumptions in both of these models limit their applicability in any exact calculations for the real atmosphere. When the survey of observational results on vertical transfer in the upper atmosphere is completed, comparisons will be made with the predictions of the theoretical models. (auth)

8390 (TID-16991) MIXING, DIFFUSION AND CIRCULATION RATES IN OCEAN WATERS. Progress Report, October 1962. (Columbia Univ., Palisades, N. Y. Lamont Geological Observatory). Contract AT(30-1)-2663. 47p.

Investigation of diffusion rates has been concerned largely with the complex instrumentation required to use dye tracer techniques in the open ocean. Continuing radiocarbon and other circulation studies are outlined. (R.J.S.)

8391 (TID-17671) THE COLUMBIA RIVER DISCHARGE AREA OF THE NORTHEAST PACIFIC OCEAN. A Literature Survey. George C. Anderson, Clifford A. Barnes, Thomas F. Budinger, Cuthbert M. Love, and Dean A. McManus (Washington. Univ., Seattle). July 1961. Contract AT(45-1)-1385. 104p.

Available data are summarized on the Columbia River discharge area and effects of the Columbia River in the Northwest Pacific. Emphasis is placed on the oceanography of the geophysical area that either is influenced by the effluent of the Columbia River or whose waters might appreciably influence the movement and mixing of this effluent. Only summary consideration is given to the Columbia River upstream from the estuary and to material having little apparent bearing on the oceanography of the river effluent. No attempt was made to evaluate the effect of radioactive waste in the river. The existing literature was reviewed and references are included. (C.H.)

8392 RADIOACTIVE COLUMBITE. E. Wm. Heinrich (Univ. of Michigan, Ann Arbor). Am. Mineralogist, 47: 1363-79(Nov.-Dec. 1962).

Columbites may be radioactive because they contain isomorphous U^{4+} (and Th^{4+}?) substituting for Fe^{2+}; they contain growth inclusions of other radioactive species (e.g., monazite); they contain exsolved uraninite; they are overgrown or partly replaced by other hypogene radioactive species (e.g., samarskite); they are coated or veined by secondary uranyl minerals (e.g., parsonsite); or because of various combinations of these. Columbite from British Columbia (9-10% U_3O_8), although apparently homogeneous when examined by means of x-ray diffraction methods, is shown to be a mixture of non-radioactive columbite and radioactive, metamict pyrochlore by means of an electron microprobe analysis. The material toddite is shown to be a mixture of columbite and samarskite. Radioactive colum-

bite is related to a particular pegmatite district, its paragenetic position, and the presence of other accompanying radioactive species. (auth)

8393 METEORITIC HYDROCARBONS AND EXTRATERRESTRIAL LIFE. Edward Anders (Univ. of Chicago). Ann. N. Y. Acad. Sci., 93: 649-64(Aug. 29, 1962).

A critical discussion is given of the comparison by Nagy, Meinschein, and Hennessy of the mass spectra of the hydrocarbons from the distillate of the Orgueil meteorite with the mass spectra of two biogenic materials, butter and sediments. The conclusion of Nagy et al. that biogenic processes occur in the universe beyond the earth, is criticized on the basis of the following facts: the mass spectra are only superficially similar; contamination is a serious problem at these low concentrations; the meteorite is very porous and hence will absorb considerable amounts of atmospheric constituents; the peak heights are not truly representative of specific compounds; the meteorite contains free sulfur, which would dehydrogenate hydrocarbons on heating; etc. (D.L.C.)

8394 AGES OF PEGMATITE AND VEIN MINERALS OF SOUTHERN KIVU (EASTERN CONGO). PRELIMINARY INDICATION ON AGES OF SUCCESSIVE PEGMATITE PHASES. G. Monteyne-Poulaert, R. Delwiche, A. Safiannikoff, and L. Cahen. Bull. Soc. Belge Geol. Paleontol. Hydrol., 71: No. 2, (1962). 24p. (In French)

The ages of pegmatite and vein minerals connected with the Kibara-Urundi-Karagwe Ankolean belt are reported. Ages of 12 minerals from Southern Kivu (Eastern Congo) have been obtained by the strontium–rubidium and lead–uranium methods. The ages fall into four age groups: (1) muscovite and microcline from a pegmatite of the Lugusha river are circa 1115 m.y. old; (2) muscovites and microclines from various pegmatites near Kamituga and the Lugusha river have ages of circa 905 m.y.; (3) two uranium minerals from one of these pegmatites, at Kobokobo, are circa 845 m.y. old; and (4) the last event is dated at circa 550 m.y. and corresponds to post-tectonic intrusions of uranium-bearing veins and thin microcline, quartz, amphibole veins. Group 1 is also represented in Northern Katanga; group 2 is found in Northern Katanga, Kivu and Rwanda; group 3 is at present restricted to Kivu; and group 4 is represented both in Kivu and Rwanda. The three first age groups are post-tectonic events of the Kibara-Urundi-Karagwe Ankolean cycle; the orogeny is therefore older than 1115 m.y. The last is in the post-Katangan time range. The pegmatites of Southern Kivu, the intrusions of which are post-tectonic events of the Kibara-Urundi belt, are known to occur in successive phases. Three of these are, at present, dated. The ages found are in the correct order of succession: (1) the first phase corresponds to the emplacement of graphic pegmatites (quartz and microcline with little muscovite) and belongs to age group 1 (1115 m.y.); (2) the next dated phase (or phases) is characterized by well developed muscovite and microcline crystals and corresponds to age group 2 (circa 905 m.y.); (3) the last dated phase is the uranium-bearing one of 845 m.y. (group 3). All phases are known to occur in the complex Kobokobo pegmatite. These preliminary data are discussed. It is concluded that in the Kibara-Urundi-Karagwe Ankolean belt the development of successive pegmatite phases forming the aftermath of one single orogenic cycle is drawn out over a very long period, of the order of 250 m.y. An A-K apparent age of 540 m.y. has been found on a microcline which is 1115 m.y. old. A similar age discrepancy occurs for another sample consisting of a single mica layer, one extremity of which is muscovite and the other extremity, biotite. The Sr–Rb age of the muscovite is 925 m.y., whereas the biotite is 550 m.y. The two "young" apparent ages are in excellent agreement and are also in agreement with the age of the youngest thermal event in the area. This is taken to show that this event was responsible for leakage of argon from the microcline and loss of strontium 87 from the biotite 550 m.y. ago from minerals respectively 1115 and 925 m.y. old. The strontium 87 lost by the biotite does not appear to have migrated to the muscovite. (auth)

8395 REPORT ON O^{18}/O^{16} IN THE WATER FROM BRACCIANO LAKE AND SAMPLES FROM SOUTHEAST OF THE LAKE. R. Gonfiantini, V. Togliatti, and E. Tongiorgi (Comitato Nazionale Energia Nucleare, [Rome]). Comit. Naz. Energia Nucl., Notiziario, 8: No. 6, (June 1962). 7p. (RT/GEO(62)6). (In Italian)

Samples were taken from drilled wells in the Casaccia zone 6 km south-east of Anguillara Sabazia. Analyses were made on a worker source, a brook, and the Bracciano Lake. Data are tabulated. (P.C.H.)

8396 URANIUM ORIGIN AND CONDITIONS OF THE DEPOSITION IN THE ITALIAN LATE-PALEOZOIC DEPOSITS. Giorgio Marinelli and Mario Mittempergher (CNEN, [Rome]). Comit. Nazl. Energia Nucl., Notiziario, 8: No. 12, 57-65(Dec. 1962). (In Italian)

Analysis of the principal processes that can create conditions favorable to substantial accumulations of uranium and the problems of transport and deposition by the mineralized solutions are discussed. A genetic classification of the uranium-bearing deposits connected with Late-Paleozoic formations is given. (auth)

8397 DETERMINATION OF β RADIOACTIVITY FROM FISSION PRODUCTS IN ITALY. Comit. Nazl. Energia Nucl., Notiziario, 8: No. 12, 85-9(Dec. 1962). (In Italian)

Daily ground-level measurements of the beta radioactivity of fission products in the atmosphere, taken in the period from September 1961 through July 1962, were continued in the months of August and September on the dust samples collected by stations operating in Italy, which furnish guaranteed data. (auth)

8398 THORIUM AND URANIUM VARIATIONS IN THE BLIND RIVER ORES. David S. Robertson. Econ. Geol., 57: 1175-84(Dec. 1962).

Drill hole results from the Algom-Quirke property on the north limb of the Blind River syncline show that thorium–uranium ratios vary between partly overlapping ore sheets in a manner that cannot be caused by hydrothermal activity. Bulk mine samples show gross regional variation and the details of ratio variation along the length of the Stanrock ore sheet where the ratio, ThO_2/U_3O_8, increases in a southeasterly direction, and the percentage of extractable thorium decreases. The variations reported support a syngenetic origin for uranium and thorium at Blind River and the original materials are believed to have been detrital. (auth)

8399 BLACK BOX BLAST DETECTION—HOPE OR HOAX? George J. Flynn. Electronics, 36: No. 1, 26-8; 30-1(Jan. 4, 1963).

The status of black-box detection systems for space and underground nuclear-blast detection is outlined. The number of seismic stations necessary to detect all underground blasts over 5 kt in Russia is estimated as 400. Detection by means of light emission, radio emission, and vlf phase shifts is also discussed. (T.F.H.)

8400 THE LOWERING OF RADIOACTIVITY OF THE Sr^{89}-CONTAMINATED WATER BY CERTAIN HYDRO-

BIONTS AND SILT. G. D. Lebedeva. Gigiena i Sanit., 27: No. 4, 88-90(Apr. 1962). (In Russian)

An attempt was made to lower the concentration of Sr^{89} in water by means of various hydrobiota and silt and to determine the effects of temperature and light on Sr^{89} uptake by marine organisms. Experiments were conducted using protococcaceae algae (Scenedesmus quadricauda), filtering organisms (Daphnia magna), mollusks (Unio pictorum), and clay is up to 100-l glass containers. The results showed that a mass development of protococcaceae algae is effective in reducing Sr^{89} activity. (R.V.J.)

8401 GAMMA BACKGROUND AT CERTAIN REGIONS OVER BARENTS SEA AND SEA SHORE. A. F. Fedorov and V. S. Zlobin (Knipovich Polar Scientific Research Inst. of Fishing Industry and Oceanography, USSR). Gigiena i Sanit., 27: No. 4, 91-4(Apr. 1962). (In Russian)

Measurements of γ background over the Barents Sea and sea shore, 2 m above sea level, during the day and night from March until Sept. 1959 are tabulated. The maximum was 20.2 μr/h over the Kola Gulf in July; the mean was 8.5 μr/h at all measured points. During the fall-winter period the average mean over the sea was 5.1 to 6.4 μr/h. (R.V.J.)

8402 THE COMPOSITE ORIGIN OF HEAVY ELEMENTS AND IRON METEORITES. Royal R. Marshall (California Inst. of Tech., Pasadena). Icarus, 1: 95-111 (Sept. 1962).

A model based on three nucleosynthesizing events preceding the formation of the solar system accounts for the origin of the r-process nuclides. The first such production occurred 13.4×10^9 years ago. It may represent an average of more than one such nuclear synthesizing event (but probably not many such events). The second event occurred 7.5×10^9 years ago, and the third occurred at the beginning of the solar system. The last two events contributed only 6 and 7%, respectively, of the r-process elements to the meteorites and planets. (These values do not necessarily include those elements, such as lead and bismuth, which are quite volatile and easily fractionated by physical and chemical means.) The range in the lead–lead ages of the stone meteorites seems to be about 0.3×10^9 years. This interval essentially coincides with that of 0.25×10^9 years between the last nucleosynthesis and the time at which the chondrite Richardton began to retain rare gases such as xenon. According to the abundance of Xe^{136} in the atmosphere, the earth may have formed as recently as 4.2×10^9 years ago. The three-nucleosynthesizing-event model was suggested by the presence of two kinds of lead which must have been incorporated into iron meteorites at or before the beginning of the solar system. Three iron meteorites (Toluca, Bishtyube, and Henbury) contain both types, a fact which implies that there were at least two stages in the formation of these meteorites. First, iron must have been segregated from two sources which differed at least in the isotopic composition of their leads; then these masses of iron must have combined, with more or less complete sintering. (auth)

8403 THE USE OF RADIOACTIVE ISOTOPES FOR MINING HYDROGEOLOGICAL INVESTIGATIONS. G. Milde. Isotopen Tech., 2: 328-35(Nov. 1962). (In German)

The principles of tracer methods with radioisotopes and examples for their application in the Lausitz region are described. It could be proved that ground water flow determinations with radioactive tracers supplement the hydrogeological plan inspection of coal fields. In addition some experience on the insertion of these methods in spongy minerals was gathered. (auth)

8404 INCREASE IN THE RADIOACTIVITY OF THE FALL-OUT IN SPRING 1962 AND THE MECHANISM OF DISTRIBUTION OF THE FISSION PRODUCTS IN THE ATMOSPHERE. V. Santholzer and V. Havlovic (Charles Univ., Prague). Jaderna Energia, 8: 422-6(1962). (In Czech)

On the basis of systematic measuring of the radioactivity of fallout in atmosphere and rain during 1961–1962 the spring increase in the activity of the fallout in the year 1962 was proved. Various mechanisms (models) of the distribution of fission products in the atmosphere are shown, some of them explaining the spring increase after megaton nuclear tests. (P.C.H.)

8405 MONTHLY WIND MEASUREMENTS IN THE MESODECLINE OVER A ONE-YEAR PERIOD. Lawrence B. Smith (Sandia Lab., Albuquerque, N. Mex.). J. Geophys. Res., 67: 4653-72(Nov. 1962). (TID-15454; SCR-565)

Variations in winds between altitudes of 180 and 275 kilofeet are shown over a 1-year period as a result of 38 observations made at the Tonopah test range in Nevada. These observations were made by radar tracking of chaff ejected from small two-stage rockets above 300 kilofeet. Two to four measurements were made one day each month throughout the year except during February and October. Measurement accuracy, fall behavior from free fall to terminal velocity, seasonal distributions, annual variations, and vertical wind shear statistics are discussed. Negative results were obtained in efforts to correlate periodicities with tidal motions and in attempts to quantify turbulence directly. However, the vertical scale of turbulence from correlation curves is found to vary from about 25 kilofeet in winter to 45 kilofeet in summer. The decay of correlation curves is compared with those from other altitude zones. Root mean square variations of turbulence estimated from the radar track are approximately 21 knots. (auth)

8406 A PROCEDURE FOR GEOCHEMICAL INTERPRETATION OF TERRESTRIAL RARE-EARTH ABUNDANCE PATTERNS. Charles D. Coryell, John W. Chase, and John W. Winchester (Massachusetts Inst. of Tech., Cambridge). J. Geophys. Res., 68: 559-66(Jan. 15, 1963).

A procedure for geochemical interpretation of rare-earth abundances in rocks and minerals is presented. The ratio of each rare-earth abundance in the sample to the corresponding value in chondritic meteorites (on logarithmic scale) is plotted as a function of atomic number Z. Normalization to chondrites compensates for element-to-element irregularities and reveals small relative abundance variations among neighboring rare earths as a result of natural processes. It is shown that increased order occurs, permitting interpolations and extrapolations to be made with fair confidence, and systematic rare-earth abundance patterns are made apparent. The usefulness of the procedure is discussed using several examples from the existing literature. (auth)

8407 LANTHANUM, EUROPIUM, AND DYSPROSIUM DISTRIBUTIONS IN IGNEOUS ROCKS AND MINERALS. John W. Chase, John W. Winchester, and Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge). J. Geophys. Res., 68: 567-75(Jan. 15, 1963).

Whole-rock samples of three oceanic basalts, one diabase, and four granites from northeastern North America, and feldspar and mica mineral concentrates from three of the granites have been analyzed for La, Eu, and Dy by means of neutron activation. By plotting on a logarithmic scale the concentration versus atomic number of each rare-earth element relative to its chondritic abundance,

it is shown that the crustal rocks all show an enrichment of La over Dy relative to chondrites. The basalts are quite uniform, but the granites are variable in the degree of enrichment of La. In basalts Eu lies close to the straight line joining La and Dy and thus appears to be normal, but in the granites Eu lies below this line by a factor of 1.6 to 3.4. Analysis of feldspar and mica mineral concentrates from the granites shows Eu to be preferentially included in the feldspar fraction. The abnormal behavior of Eu is attributed to its being in the 2+ oxidation state at some point during magmatic crystallization. (auth)

8408 THE LANTHANUM, EUROPIUM, AND DYSPROSIUM CONTENTS OF TWO TEKTITES. John W. Chase, Charles C. Schnetzler, Gerald K. Czamanske, and John W. Winchester (Massachusetts Inst. of Tech., Cambridge). J. Geophys. Res., 68: 577-9(Jan. 15, 1963).

The contents of La, Eu, and Dy were determined by neutron activation in a moldavite and an indochinite to be 29, 0.83, 2.8 and 47, 1.5, 5.3 ppm, respectively. When the logarithms of the ratios of these abundances to corresponding bronzite chondrite values are plotted versus atomic number, a pattern is revealed which may be compared with corresponding patterns for four granites and three oceanic basalts. The tektite pattern resembles the granites more than the oceanic basalts, but the pattern is quantitatively the same for both tektites, in contrast to granites, which tend to be variable. (auth)

8409 ON NATURAL ATMOSPHERIC PRECIPITATION OF RADIOACTIVITY AND PROBLEMS RELATED TO IT. B. I. Styro and C. A. Garbaliauskas (Inst. of Geology and Geography, Academy of Sciences, Lituanian SSR). Lietuvos TSR Mokslu Akad. Darbai, Ser. B, No. 4 (31): 23-39(1962). (In Russian)

Measurements made of the radioactivity of atmospheric precipitations during 1957 to 1960 showed an average of 1.69×10^{-11} C/g and a maximum of 16.1×10^{-11} C/g. An analysis was made of the type and synoptic situation of the measured precipitations. An hypothesis was suggested and calculations were made of the rejuvenation of the precipitates during their precipitation, and it is shown that the natural radioactivity is not subject to a dilution effect. Data are given on the pseudonatural atmospheric radioactivity increase during the last ten years. (R.V.J.)

8410 DENSITY GRADIENT SEPARATION OF PLANKTON AND CLAY FROM RIVER WATER. William T. Lammers (Tennessee Valley Authority). Limnol. Oceanog., 7: 224-9(Apr. 1962).

A method involving centrifugation is described by which lake or river water can be fractioned into noncolloidal organic matter, noncolloidal inorganic matter, colloids, and solutes. These isolated fractions may then be analyzed for radionuclide accumulation both qualitatively and quantitatively. (auth)

8411 A RADIOISOTOPE TECHNIQUE FOR TRACING AIR MOVEMENTS IN CLEAR AIR AND IN CLOUDS. R. A. Fookes (Australian Atomic Energy Commission), J. S. Watt, and J. A. Warburton. Nature, 196: 328-9(Oct. 27, 1962).

A new technique using radioisotopes for tracing air movements in clear air and in clouds is being developed principally for use in experiments related to cloud seeding. The tracer is released from an aircraft and, during a series of passes, the γ rays emitted by the material about the aircraft are detected by a large scintillometer. From the measurements of γ-ray intensity, the movement of the tracer may be followed and information obtained on its spatial distribution. The method has been tested in ten separate flight experiments. In the first two experiments Xe^{133} was used, but this was abandoned in favor of Cu^{64} in the form of finely divided CuO. Up to 2-c quantities of $Cu^{64}O$ have been released and traced with an omnidirectional scintillation detector for periods up to 50 min. (L.T.W.)

8412 CHARACTERISTICS OF EARLY FALL-OUT FROM THE RUSSIAN NUCLEAR EXPLOSIONS OF 1961. D. H. Peirson and J. R. Keane (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature, 196: 801-7 (Dec. 1, 1962).

The characteristics of early fallout from the Russian nuclear weapons tests of Sept. to Nov. 1961 were investigated. The series yielded approximately 25 megatons of fission products. Fallout of the short-lived fission products was controlled by the rapid circulation of clouds of debris in the troposphere. Clouds generally traveled eastward and reached the United Kingdom in about 15 days. The rate of dry deposition measured on artificial surfaces was compared with the rate of deposition measured in rainfall. Data are presented on the concentration of Ba^{140} and I^{131} in air, rain, milk, and on grass, and on the concentration of Zr^{95} in air samples. (C.H.)

8413 RADIUM CONTENT IN NILE WATER. Abdel Fattah El Nadi and M. Ammar (Cairo Univ.). Proc. Math. Phys. Soc. (U.A.R.), No. 24, 7-10(1960). (In English)

A study of the radium concentration in Nile water was carried out by the emanation method using a cylindrical ionization chamber. The results obtained indicate that the amount of Ra lies in the range $0.98 \pm 0.14 \times 10^{-16}$ g/cc before and after the period of Nile flood, while it increases to the range $1.74 \pm 0.42 \times 10^{-16}$ g/cc during the flood period itself. (auth)

8414 THORIUM CONTENT IN NILE WATER. Abdel Fattah El Nadi and M. Ammar (Cairo Univ.). Proc. Math. Phys. Soc. (U.A.R.), No. 24, 11-16(1960). (In English)

A study of thorium concentration in Nile water was carried out by the flow method using a cylindrical ionization chamber. The results indicate that the amount before and after flood has an average of $14.7 \pm 0.6 \times 10^{-8}$ g/cc, while during flood it decreases to an average of $10.1 \pm 0.7 \times 10^{-8}$ g/cc. This decrease may be attributed to the effect of the presence of suspended clays which may adsorb Tn gas on its surface and thus decrease the amount of Tn expelled during the process of deemanation. (auth)

8415 RADON AND THORON CONTENT IN SOIL AIR AT GIZA. Abdel Fattah El Nadi and Hassan Omar (Cairo Univ.). Proc. Math. Phys. Soc. (U.A.R.), No. 24, 49-56 (1960). (In English)

The radon and thoron content in soil air at Giza was studied by using the emanation method. Four depths of 50, 100, 150, and 200 cm were investigated and it was found that the radon and thoron concentrations increase with depth. The mean value of the radon concentration in the depths 50, 100, 150, and 200 cm are 13.5, 43.9, 56.7, and 85.3×10^{-15} curie/cc respectively while the corresponding values of thoron equivalent concentrations are 15.4, 26.3, 64.5, and 72.7×10^{-15} curie/cc. (auth)

8416 GROUND WATER QUANTITY MEASUREMENT ON THE FOOT OF MT. FUJI BY THE USE OF RADIOISOTOPES. Toshiro Ochiai and V. C. Rodriguez (Agricultural Engineering Research Station, Ministry of Agriculture and Forestry). Radioisotopes (Tokyo), 11: 373-9(Nov. 1962). (In English)

The method and results of the measurement with an improved radioisotope velocity meter, and gamma-gamma logging with radioisotopes applied to ground water investigation in Fujinomiya near Mt. Fuji are described. With the

new radioisotope velocity meter, velocity and direction of ground water flow can be determined at the same time. In order to determine the depth to which the isotope velocity meter should be placed and to compare the geological column of two test borings, radioactive logging (Co^{60} 1 mc) was made. Based on these results, it is concluded that the lava strata with medium scattering intensity are of medium porosity and have the average ground water velocity, so it was decided to put the velocity meter at 42 meters depth. The computed ground water velocity was 1.316×10^{-3} m/sec for No. 1 boring and 1.310×10^{-3} m/sec for No. 2 boring. Radioisotope I^{131} solution (0.018 μc/ml) was used. Direction of ground water flow was determined by the dilution ratio. On the basis of the data obtained by the present measurement, the amount of the ground water which flows 1 m wide section was estimated. (auth)

8417 GROUND WATER INVESTIGATION USED ^{131}I AND FALLOUT CESIUM AS TRACER. Tsunenobu Terasaki, Yoshiyuji Yamanobe, Hachiro Niizeki, and Tomoyoshi Kamikawa (Yamagata Univ., [Japan]). Radioisotopes (Tokyo), 11: 380-8(Nov. 1962). (In Japanese)

A method for ground water investigation is described which employs I^{131} and fallout cesium as tracer. To demonstrate the feasibility of the method, measurements were made on ground water samples from "the Mamigasakigawa Fan". From the measurements which employed I^{131} as tracer, the velocity of the free ground water was 0.6 m per hour at a place located at the top part of the Fan and was 2.0 m per hour at another place which was not far from the former. It showed that there exists considerable fluctuation in velocity from place to place. The deep ground water would be considerably slower than the free ground water. It was found that the artesian ground water at the edge part of the Fan was contaminated with fallout cesium. From this fact and measurements of fallout cesium since 1957 it can be supposed that the artesian ground water soaking into ground at the top of the Fan reaches the edge part of the Fan in 3 or 4 years. (auth)

8418 ISOTOPIC FRACTIONATION OF URANIUM IN SANDSTONE. John N. Rosholt (U. S. Geological Survey, Denver), William R. Shields, and Ernest L. Garner. Science, 139: 224-6(Jan. 18, 1963).

Relatively unoxidized black uranium ores from sandstone deposits in the western United States show deviations in the uranium-235 to uranium-234 ratio throughout a range from 40% excess uranium-234 to 40% deficient uranium-234 with respect to a reference uranium-235 to uranium-234 ratio. The deficient uranium-234 is leached preferentially to uranium-238 and the excess uranium-234 is believed to result from deposition of uranium-234 enriched in solutions from leached deposits. (auth)

8419 COMPOSITION AND PROPERTIES OF NATURAL RADIOACTIVE AEROSOLS. A QUANTITATIVE EXPANSION OF THE RESEARCH OF ELSTER AND GEITEL. P. H. Wieser and K. Stierstadt (Universität, Munich). Z. Physik, 169: 386-408(1962). (In German)

The influence of an electric field, acting on the deposition of natural radioactive aerosols, was investigated. At an overall aerosol concentration of 10^4 particles per cm^3 only 3% of the Ra-Ar activity exists in an atom-disperse state. 90% of the radon decay products are attached on particles with a radius $<10^{-5}$ cm. The size spectrum of natural-occurring radioactive aerosols was calculated. The result is in good agreement with experience. (auth)

8420 SHOCK WAVE INTERACTIONS WITH SHIFTING BOUNDARY IN ELASTIC-PLASTIC MEDIUM. G. M. Lyakhov and N. I. Polyakova. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 89-95(Sept.-Oct. 1962). (In Russian)

Data on shock wave interaction with shifting elastic-plastic boundaries ($\sigma = \sigma(\epsilon)$) at small intensities were used for analyzing the problem of plane shock wave interactions with shifting obstructions or boundaries at high energies. (R.V.J.)

8421 PLEOCHROIC HALOES. E. E. Picciotto and S. Deutsch (Université Libre, Brussels). p.263-310 of "Summer Course on Nuclear Geology." Pisa, Italy, Comitato Nazionale per l'Energia Nucleare, 1960. (In English)

A review is presented on pleochroic haloes in minerals, a coloration effect due to α rays. The evolution of the coloration is divided into three stages: (1) a normal stage, in which coloration increases linearly with dose; (2) a saturation stage, in which coloration is constant with dose; and (3) an inversion stage, in which coloration decreases with dose. Research on the dimensions and ages of the haloes is reviewed. It is concluded that the ages of the haloes can be measured only relatively to haloes in biotites with ages determined by other methods. The effects of temperature on the haloes, and the haloes in minerals other than biotites are discussed. The unsolved problem of the 8.6 μ ring is discussed. (D.L.C.)

8422 AN EXPERIMENTAL INVESTIGATION OF DISCORDANT ISOTOPIC AGES IN ZIRCONS. S. Deutsch (Universite Libre, Brussels) and L. T. Silver. p.346-59 of "Summer Course on Nuclear Geology." Pisa, Italy, Comitato Nazionale per l'Energia Nucleare, 1960. (In English)

A study was made on the effects of zircon grain size, zoning, and morphology on the discordant ages of a sample from the Johnny Lyon granodiorite in Arizona. The granodiorite was crushed, the zircons screened, and the uranothorite washed out with HNO_3. Isotopic age analyses (Pb^{206}/U^{238}, Pb^{207}/U^{235}, and Pb^{207}/Pb^{206}) were carried out on the uranothorite washes and the screened zircons, and concordia plots are given. It is possible to explain the results on a simple two-episode history originating $\sim 1650 \times 10^6$ years ago and profoundly disturbed $\sim 90 \times 10^6$ years ago. (D.L.C.)

8423 VOPROSY RUDNOI RADIOMETRII. (Problems in Ore Radiometry). V. L. Shashkin, ed. Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962. 243p.

Fifteen articles are included on exploration methods for radioactive ores. Studies were made of γ spectra, coefficients for quantitative interpretation of γ logs, and applications of directed radiometers. Complex logging, rapid analysis, and γ sampling methods are described. The book was designed for geologists, geophysicists, and geochemists interested in prospecting, exploring, and treating radioactive ores, as well as for specialists studying radiation dosimetry. (R.V.J.)

8424 GEOLOGIYA MESTOROZHDENII REDKIKH ELEMENTOV. OSNOVNYE VOPROSY GEOKHIMII REDKOZEMEL'NYKH ELEMENTOV I ITTRIYA V ENDOGENNYKH PROTSESSAKH. (Geology of Rare Earth Deposits. The Basic Problems in Rare Earth and Yttrium). I. V. Shvei. Moscow, State Publishing House of Scientific-Technical Literature on Geology and Conservation of Natural Resources, 1962.

Properties of rare earths and yttrium were analyzed, and their distribution in the earth's crust and accessory minerals was studied. The behavior of rare earths and yttrium in endogenous processes (magmatic, pegmatitic, pneumatolytic-hydrothermal) was investigated. Extensive bibliographies are included. (R.V.J.)

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Refer also to abstracts 7712, 7718, 7719, 9896, and 10025.

8425 (AERE-R-4094) RADIOACTIVE FALL-OUT IN AIR AND RAIN RESULTS TO THE MIDDLE OF 1962. R. S. Cambray, E. M. R. Fisher, G. S. Spicer, C. G. Wallace, and T. J. Webber (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England and United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England). Nov. 1962. 50p.

Samples of atmospheric dust and rain were collected from the United Kingdom and overseas. Results are presented of the analyses of these samples for various fission products. As a consequence of the Russian nuclear explosions in the autumn of 1961 the concentrations of Cs-137, in air at ground level over the United Kingdom increased to levels that are about three times those of 1960 and 1961 and about one third of the levels of 1959. The concentrations of Cs-137 and Sr-90 in rain at Milford Haven have increased in greater proportion than those in air. Furthermore because of higher rainfall the deposition of Sr-90 at Milford Haven in the first six months of 1962 is similar to that in the same period of 1959. The proportion of new radioactivity in samples collected in the United Kingdom during 1962 is about 85% for strontium-90 in rain and 60% for cesium-137 in air. The new debris is mainly restricted to the northern hemisphere although small but significant amounts were transferred very rapidly to the southern hemisphere. Before the Russian tests in 1961 the concentrations of long-lived fission products measured in rainwater were approaching an apparent equality between the northern and southern hemispheres. Integration over the world of the deposition of strontium-90 in rain provides an estimate of the total global deposition to the end of 1961. The velocity of dry deposition, measured upon artificial surfaces, increased considerably during the period of tropospheric fallout from September to November 1961. Concentrations of Zr-95 and Ba-140 in air and rain, using a daily or weekly sampling period are given in an Appendix. (auth)

8426 (CDRP-182-107) THE POSSIBLE USE OF ANALOG COMPUTERS FOR THE EQUIVALENT RESIDUAL DOSE COMPUTATION. W. O. Wade, L. F. Wagner, and M. B. Hawkins (California. Univ., Berkeley. Inst. of Engineering Research). Oct. 30, 1962. Contract CD-SR-58-40. 11p.

The equivalent residual dose concept was recommended by the National Committee on Radiation Protection for evaluating radiation exposure in emergencies. When applied to the exposure of personnel in complex operational situations for the post-attack period of a nuclear war, the dose calculation becomes complicated. Schematic diagrams describing the computation were developed and the parametric limits established as a basis for preliminary studies of the feasibility of using mechanical and electronic analog computers. (auth)

8427 (HW-75431) EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD, JULY–SEPTEMBER 1962. J. W. Vanderbeek, ed. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 12, 1962. Contract AT(45-1)-1350. 31p.

Comprehensive surveillance of the occurrence of radioactive materials in the air, water, and foodstuffs was continued in the vicinity of the Hanford plant. The measurements for the third quarter of 1962 showed increases in the quantities of radioactive materials in the air as a result of world-wide fallout from weapons testing. This resulted in concentrations of I^{131} in local milk about double those found last quarter and which were similar to those observed in other parts of the Pacific Northwest. The amount present, however, would not have resulted in radiation exposures to human thyroids in excess of the Radiation Protection Guide recommended by the Federal Radiation Council. Radioiodine released by the Hanford plant probably constituted less than one-fourth of that found in the milk. Radioisotopes discharged to the Columbia River with the reactor cooling water continued to be the principal Hanford source of radioactive materials in the environs. With the lower river flow this quarter, there was an expected increase in the concentration of the radioisotopes in the river water and some increase in the calculated exposure to persons drinking water derived from the river. For the 12 months ending September 1962, the estimated exposure to the gastrointestinal tract of persons drinking water at Pasco amounted to about 3 percent of the applicable limit recommended by the National Committee on Radiation Protection and Measurements (NCRP). This is about half that estimated for the 12 months ending September 1961. The usual seasonal rise in the concentration of radiophosphorus in Columbia River fish occurred during the quarter and the level was essentially the same as observed last year at this time. For persons who eat them in quantity, locally caught fish continue to constitute the most significant source of radioisotopes. When the intake of isotopes from fallout and drinking water (at Pasco) are combined with intake from fish, the total rate of intake of bone-seeking radioisotopes could amount to about 30 percent of that recommended by the NCRP. Natural background radiation continues to be the largest single source of environmental exposure for the majority of persons in the Tri-City area. (auth)

8428 (HW-SA-2276) A TEST PROCEDURE FOR EVALUATING RESPIRATORY PROTECTIVE DEVICES. D. E. Wisehart (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [nd]. Contract AT (45-1)-1350. 11p.

A test procedure for evaluating respiratory protective devices is presented. The test includes measurements of overall leakage through accessories on the devices, such as valves, lenses, and speaking diaphrams; and by means of an inadequate facepiece seal. Also points where leakage occurs may be pinpointed. Results obtained together with canister penetration data permit an assessment of the overall protection afforded. Thus, information is obtained that enables an optimum choice of respiratory protective equipment and indicates its proper use. (auth)

8429 (NP-12393) PRESENT TRENDS IN FUEL TRANSPORTATION. Eurochemic Technical Report No. 109. F. Marcus (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium). June 6, 1961. 27p.

A review is presented of the status of irradiated fuel transportation in Europe today, with special regard to Eurochemic shipments. Shipping regulations prepared by IAEA and USA are described briefly, and the types of shipments to, from, and in Europe are considered. Construc-

tions and proposed designs of casks are discussed. Opinions on the regulations et al. discussed in the report ETR-94 are given. (D.L.C.)

8430 (NP-12397) ESTIMATION OF THE ATMOSPHERIC DILUTION FACTOR OF THE EUROCHEMIC PLANT CHIMNEY. J. J. H. Alderhout and H. H. Ph. Moeken (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium). Sept. 6, 1961. 14p. (ETR-118)

In order to come to an estimate of the atmospheric dilution factor of the Eurochemic plant chimney averaged over a year, two equivalent formulas were derived for the minimum, long-period average atmospheric dilution factor for each wind direction. These formulas are based on the existing atmospheric diffusion models of Bosanquet-Pearson and Sutton respectively. With the aid of available mean windrose date observed at Mol and Uccle and of diffusion parameters from the literature, a numerical value for the minimum atmospheric dilution factor averaged over a year, could be calculated for each wind direction. For the most unfavorable wind direction, this factor amounted to about 5×10^5 (i.e., continuous emission of 1 curie/sec gives rise to an air concentration at ground level of maximum 2×10^{-6} curie/m^3). The results of both derived formulas differed by only a factor of 0.7. It is thought that the found values for the respective atmospheric dilution factors are realistic values on the conservative side which can only be made more accurate after sufficient direct experimental determinations of the diffusion parameters have been made in the Mol region. (auth)

8431 (NYO-9771) STATISTICAL ANALYSIS OF THE FREQUENCY AND SEVERITY OF ACCIDENTS TO POTENTIAL HIGHWAY CARRIERS OF HIGHLY RADIOACTIVE MATERIALS. F. F. Leimkuhler, M. J. Karson, and J. T. Thompson (Johns Hopkins Univ., Baltimore). July 1961. Contract AT(30-1)-1477. 182p.

The probability of accidents to tractor semitrailers is developed through analysis of accident frequency data in relation to season; geographical factors; road type, traffic and population density; and type of carrier business. Maximum likelihood rates are developed for the potential carriers of radioactivity. Impact characteristics of accidents are studied through the analysis of mass, speed, and energy relations and the effect of these on vehicle and cargo damages is explored. (auth)

8432 (AEC-tr-5445) SAFETY RULES FOR WORKING WITH RADIOACTIVE MATERIALS. B. M. Zlobinskii. Translation of "Bezopasnost Rabot s Radioaktivnymi" (a publication of the State Scientific-Technical Publishing House of Literature on Ferrous and Nonferrous Metallurgy, Moscow, 1961). 356p.

The problems of safety techniques in the use of radioactive substances in scientific research and in industry, the biological action of ionizing radiation, the basic principles of protection, the organization of work using radioisotopes, the construction of work and auxiliary rooms, equipment for work with isotopes, protective shielding, the removal of waste products and deactivation, individual protective devices, and dosimetric control are discussed. The book is designed for scientific and engineering technical workers of research institutions and industrial enterprises using radioactive substances and health physicists. (C.H.)

8433 (CEA-tr-A-1100) PROBLÈMES POSÉS PAR L'ÉTABLISSEMENT DES PREUVES DE CAUSALITÉ À FOURNIR PAR LES VICTIMES D'IRRADIATION. (Problems Posed in Establishment of Proof of Causality as Furnished by Victims of Irradiation). W. Schulli. Translated into French from Atomwirtschaft, 6: 557-60(1961). 17p.

An irradiation victim claiming reparation has to prove that he has actually suffered injury and that it can be attributed to a given cause. If one maintains a principle of individual civil responsibility, the task of the claimant, in so far as causality proof, will be facilitated neither by the attenuation of needs nor by admitting the principle of "probability or indices." The problem of causality proof is by no means resolved by American judiciary practice that differentiates the litigations by the "50% rule," which is a question of present or future damages. This principle is of value for the claimant only when the cause of the illness is established. In this case he has only to prove that the dose received is statistically sufficient to provoke the illness he has. It is highly doubtful that one would choose the system "judicial fiction." It is equally improbable for reasons given that the system of "solidarity responsibility" would be adopted. The possibility of collective responsibility and state responsibility remains. In the first case the claimant would have to bear the proof that the damages to be recovered are the fault of a member of the group collectively responsible without having to designate it by name. In the second case he would be relieved of this obligation. But in all cases the victim must prove that he has suffered damages imputable to radiation. (tr-auth)

8434 RADIATION IN NEW YORK STATE INDUSTRY. TRENDS IN UTILIZATION AND STATUS OF HEALTH PROTECTION, 1957-1962. Albert Abrahams (New York State Dept. of Labor, New York). Arch. Environ. Health, 5: 473-8(Nov. 1962).

New York State Industrial Code Rule No. 38, promulgated in Dec. 1955, requires registration with the Labor Department of installations where radiation sources are used or stored and notification of the Department of all changes in the installations. An evaluation is presented of registration and enforcement of the code rule for the first 6 years of operation. (C.H.)

8435 RADIATION PROTECTION IN THE ATOMIC ENERGY AUTHORITY. Atom, No. 72, 249-56(Oct. 1962).

The health and safety organization of the United Kingdom Atomic Energy Authority is discussed. It is pointed out that about 40,000 persons are involved in operations employing atomic energy and that about one-half of this number are persons in industrial occupation with little or no previous scientific or technical training. The operations are extremely varied and some are on a large industrial scale. To achieve high standards of radiological health and safety in these circumstances calls for careful plant design, carefully considered operating procedures, clearly defined instructions, effective communications, thorough staff training at all levels, good discipline, and effective supervision, as well as adequate numbers of qualified health and safety specialists. The radiation exposure record of the Authority's employees from 1957 through 1961 is reviewed. (C.H.)

8436 INJURY FROM DIAGNOSTIC RADIOGRAPHY AND RADIATION THERAPY. E. Zdansky (Bürgerspital, Basel). Deut. Med. Wochschr., 86: 1289-93(July 7, 1961).

A review on injuries from diagnostic radiography and radiotherapy is presented. It is felt that maximum permissible doses should be much higher for the general populations than for patients or occupationally exposed persons, since marriage within such groups could lead to homozygous combination of radioinduced recessive mutations. (P.C.H.)

8437 RADIATION DOSES IN PATIENTS DURING RADIODIAGNOSIS, THEIR MAGNITUDE, VARIABILITY, AND SIGNIFICANCE. Walter Seelentag (Bundesgesundheitsamt Institut für Wasser-, Boden-, und Lufthygiene, Berlin). Deut. Med. Wochschr., 86: 2513-23(Dec. 29, 1961).

The influence of various technical factors, such as type of apparatus and procedure, on the amount of radiation received by patients undergoing diagnostic tests is discussed. Effects on the gonads, with respect to genetic alterations, are considered in particular. Various means of reducing the dose received by the gonads during thoracic and abdominal radiography are illustrated; use of the methods allows the gonadal dose to be reduced to less than one-hundredth that when such precautions are not observed. The information gained from radiodiagnostic procedures is considered to outweigh the risks, except perhaps in young children or the fetus in utero. The genetic risk can be reduced to or below that calculated from one-fifth of the natural background by observing precautionary measures. (H.H.D.)

8438 RADIATION DOSE AND DOSE UNITS; INTRODUCTION TO DOSIMETRIC PROBLEMS OF RADIATION EXPOSURE. W. Seelentag (Bundesgesundheit Institut für Wasser-, Boden-, und Lufthygiene, Berlin-Dahlem, Ger.). Deut. Med. Wochschr., 86: 2542-7(Dec. 29, 1961).

Definitions of dose units and various aspects of dosimetry are reviewed. (H.H.D.)

8439 ON THE PROBLEM OF RADIATION RISKS FROM SERIAL RADIOGRAPHIC STUDIES. POSITION TAKEN ASSOCIATION OF GERMAN RADIOLOGISTS. H. J. Melching (Universität, Freiburg i. B.), H. R. Beck, and E. Scherer. Deut. Med. Wochschr., 87: 2031-2(Oct. 5, 1962).

The possible effects of diagnostic x rays on health are discussed, particularly with respect to leukemogenesis and genetic mutations. It is estimated that, in general, by the use of modern techniques single radiation exposures during radiologic studies deliver ~0.2–0.5 r to skin, 0.01–0.1 r to bone marrow, and 0.05–0.2 mr to gonads. Attempts were made to assess the risk of leukemia from doses in radiologic procedures, on the basis of the experience in Hiroshima and in radiology; however, the absence of threshold doses in the phenomena allowed only speculative assessment of the risk. Until the probability of the long-term detrimental effects of radiation can be expressed on a mathematical basis, the relatively slight risks of diagnostic doses can only be contrasted to the expected medical benefits. Doses of 0.1 mr to the bone marrow or gonads in diagnostic studies do not exceed the mean yearly dose from natural, background sources. (H.H.D.)

8440 RADIOACTIVE POLLUTION—A NEW CONCERN IN PUBLIC HEALTH. J. C. Collins (Univ. of Manchester, Eng.). Effluent and Water Treat. J., 2: 335-7 (June 1962).

Public health aspects of atomic energy are discussed from the viewpoint of the possibility that radioactive pollution of the environment may occur, either over large areas of the Earth's surface as a result of nuclear weapons tests, or locally through the discharge of industrial radioactive wastes. It is pointed out that radioactive material set free in the environment by either of these means could enter food chains and result in ingestion by man. Emphasis is placed on the passage of radioisotopes through waste treatment and water treatment plants. Calculated maximum permissible levels of contamination of air, water, and foodstuffs are discussed. Data are presented on nuclear power stations in the United Kingdom in 1962 and the half-lives of fission products and isotopes in medical use of significance in public health. (C.H.)

8441 FOODS FOR FALLOUT SHELTERS. 1. THE PROBLEM. Robert L. Olson, Vern F. Kaufman, and Eleanor C. Taylor (Western Regional Research Lab., Albany, Calif.). Food Technol., 16: No. 8, 21-4(Aug. 1962).

How food supply and use interact with the design, management, and function of fallout shelters is discussed to indicate areas of research that will lead to a satisfactory plan for provisioning shelters. Some basic assumptions are made as to fallout-shelter requirements and human needs during shelter occupancy. About 2000 calories per occupant per day is considered appropriate. Cost of a shelter food program should be kept to a minimum to make any such program available to as large a population as possible. There are 2 major procedures for provisioning fallout shelters. One procedure would be to channel food supplies through temporary storage in shelters into normal food use. This system is appropriate for most family-type shelters, shelters in buildings that house restaurants, and shelters in organized institutions where food is customarily served. Or, food stocks would be held until no longer acceptable, and then replaced with fresh stocks. This system is contemplated for most community-type shelters and all other shelters that do not customarily house food-serving facilities. The selection and maintenance of a food stockpile in such shelters are discussed. The influence of various conditions in the shelter during the stand-by period (temperature, humidity, air contaminants, vermin) on food stores is also considered. (H.H.D.)

8442 FOODS FOR FALLOUT SHELTERS. II. FOOD STORAGE, PACKAGING, AND SURVEILLANCE. Marcell E. Juilly, Vern F. Kaufman, Robert L. Olson, and Eleanor C. Taylor (Western Regional Research Lab., Albany, Calif.). Food Technol., 16: No. 8, 25-7(Aug. 1962).

Stability of various food products, stockpiled for long periods in fallout shelters, is considered in relation to packaging, periodic sampling, and replacement. Among the most stable foods are highly refined foods, such as salt and sugar. With adequate package protection, they remain unchanged indefinitely. Unprocessed cereals and seed foods (beans and peas) retain acceptable food quality for 20–50 years if they are protected from insect infestation and moisture. Milled and ground cereals may also have a long shelf life, although they are more subject to oxidative changes than unprocessed cereals. Dehydrated foods, as a class, are stable, and with proper control of moisture content and with formulation and packaging to resist deterioration, a shelf life of 5–10 yr should be attainable. The packaging used for shelter foods is unusually important. Tin cans satisfy most requirements, but may not have adequate durability in a damp shelter. If shelter stockpiles are to be held over an indeterminate period, stored food must be inspected and replaced before it becomes unacceptable. Regular inspection will be necessary. Data on the deterioration rates of foods do not apply specifically to shelter circumstances. (H.H.D.)

8443 FOODS FOR FALLOUT SHELTERS. III. FOOD SELECTION AND RATION CONCEPTS. Eleanor C. Taylor, Marcel E. Juilly, and Robert L. Olson (Western Regional Research Lab., Albany, Calif.). Food Technol., 16: No. 9, 39-45(Sept. 1962).

Factors associated with the period of shelter occupancy and various proposals for shelter rations are considered. The need for a high degree of acceptability is emphasized. Foods normally acceptable, if provided to the extent of 2000 calories per day, will probably contain the minimum

essential nutrients. The amino acid balance should be satisfactory if dried milk or some other protein-complete food supplies part of the protein in the diet. However, high protein level is contra-indicated, if the water supply in a shelter is limited, to minimize renal activity. Ideally, a shelter food should satisfy the following criteria: palatable, or at least acceptable, to the majority of the shelter population; good storage stability, preferably a shelf life of 5–10 yr; widely available; low total cost; simple preparation required; preparation requiring a minimum of fuel and producing a minimum of heat and vapor; minimum trash volume; relatively low protein level; and high bulk density to conserve space in the shelter. (H.H.D.)

8444 FOODS FOR FALLOUT SHELTERS. IV. A SPECIAL SHELTER RATION BASED ON A CEREAL WAFER. Robert E. Ferrel, James W. Pence, Robert L. Olson, and Eleanor C. Taylor (Western Regional Research Lab., Albany, Calif.). Food Technol., 16: No. 9, 45-9(Sept. 1962).

In view of the need for protein limitation and high carbohydrate content of shelter rations, a wheat wafer was developed. The formulation is: 79.5% bulgur, 10% fat (hydrogenated vegetable oil, melting point 116–8°F, iodine value 50), 10% dry malt extract, and 0.5% salt. The bulgur used can be made from either red or white wheats. Bulgur processing consists of raising the moisture content of whole wheat to at least 40%, gelatinizing the starch completely by cooking in steam either at atmospheric pressure or at about 20 psi, drying the product to about 10% moisture, and milling slightly to remove part of the bran. The wafers weigh 20 g and have a caloric value of 85. They were pressed to about $\frac{1}{4}$ in. thick and either 2 × 2 in. square or circular with 2.25 in. diameter. Rancidity was detected in wafers stored for 2 months but this was avoided by packaging them in nitrogen. In shelter habitability tests, the wafers were found to have a high degree of acceptability and palatability. (H.H.D.)

8445 MASS ROENTGENOGRAPHIC EXAMINATIONS OF THE STOMACH. H. Irie, K. Murakami, H. Soeda, K. Harada, and T. Fujimoto (Kyushu Univ., Fukuoka). Gan no Rinsho, 7: 426-30(1961).

Following basic studies, mass screening for stomach cancer by photofluorography was carried out on 2053 people in 1958–1959. Usually 5 roentgenograms were taken at 5 positions. False positive results were often noted in the duodenal bulb. The exposure dose of x rays on the backs of the examinees was approximately 0.54 r at each examination, while in the reproductive organs it was 1.5–3.0 Mr in males and 2–7 Mr in females for 5 examinations. The results suggest that the examination should be avoided in those less than 35 years old. The exposure to x rays on the part of the examiner was less than 30 Mr when 60 people were examined in a day. In some cases gastric cancer developed 7 months after the screening; therefore, it is emphasized that the screening should be repeated every 7 months. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

8446 SCATTERED RADIATION FROM LARGE Cs^{137} SOURCES. L. Costrell (National Bureau of Standards, Washington, D. C.). Health Phys., 8: 491-8(Oct. 1962).

Measurements were made to determine the scattered radiation to be expected from typical multicurie Cs^{137} installations. For the cesium pellet sources investigated the scattered intensity ranged from 12 to 21% of the total incident radiation intensity. The source capsule is responsible for scattered intensity of about 8% with the source material contributing the bulk of the balance. The source material scatter, for a source diameter of 3.6 cm, is about 5% per centimeter for source thicknesses of up to about 1.5 cm. (auth)

8447 A SUMMARY OF RADIATION EXPOSURES RECEIVED BY WORKERS IN MEDICAL X-RAY DEPARTMENTS FROM 1950–1960. C. K. Spalding and R. F. Cowing (New England Deaconess Hospital, Boston). Health Physics., 8: 499-502(Oct. 1962). (TID-14622)

Exposure to ionizing radiation received by workers in medical x-ray departments in 106 hospitals in the New England area over the past ten years has not appreciably changed even though the number of x-ray films taken has increased considerably. Data collected after monitoring a total of 1200 persons for varying periods of time show that 4% of the x-ray personnel experience exposure above 100 mr/week. The reasons for these exposures have been tabulated and present a definite need for education and understanding of health physics problems by technical personnel in both fields. (auth)

8448 EARLY X-RAY PROTECTION IN THE UNITED STATES. Ronald L. Kathren (Univ. of Pittsburgh). Health Phys., 8: 503-11(Oct. 1962).

The first decade of the x-ray is examined from the standpoint of radiation protection. The social, legal, and biological forces which underscored the need for protection are presented along with the improvements of the technical aspects of x-ray production. It is significant to note that the principles of x-ray protection so well known today were almost all elucidated in the first decade after the discovery. (auth)

8449 INFLUENCE OF CONTINUING CLINICAL OBSERVATIONS ON DOSE ESTIMATES ONE YEAR AFTER A RADIATION ACCIDENT. M. Ingram, J. W. Howland, C. L. Hansen, Jr., H. Mermagen, and C. R. Angel (Univ. of Rochester, N. Y.). Health Phys., 8: 519-22(Oct. 1962).

Delayed manifestations of x-ray injury in the most severely injured casualty in the Lockport Incident include effects on the nervous system, vascular system, testes, and skin. Only one of the most seriously injured men has shown prominent late effects. Health of the others corresponds to their respective conditions before exposure. Earlier estimates of dose may be modified in some of the cases on the basis of retrospective analysis of the clinical courses. Clinical data are summarized and modified dose estimates discussed. (auth)

8450 NEUTRON DOSE MEASUREMENTS BY AN ATTENUATION TECHNIQUE. S. Block and F. J. Shon (Univ. of California, Livermore). Health Phys., 8: 533-41 (Oct. 1962).

A technique was developed for finding the RBE dose-rate and average energy of stray neutron radiation. Neutron energies can be measured by applying the fact that the spatial variation of a thermal flux formed in a moderating material is a function of the fast flux energy distributions. An attenuation curve is plotted using polyethylene disks as neutron absorbers and a BF_3 counter as the detector. Several curves are presented, including relaxation length vs. energy, relaxation length vs. dose-rate per unit neutron flux, and the calibration curve of relaxation length vs. dose-rate per count per min. The system is compared to the double moderator dosimeter of DePangher. (auth)

8451 Sr^{90} IN HUMAN BONE (DENMARK, 1958-1961). H. Levi (Univ. of Copenhagen), J. Lindemann, and A. Nielsen. Health Phys., 8: 555-8(Oct. 1962).

Bones from human fetuses, still-born infants, and children to the age of 15 years were analyzed for Sr^{90} between 1958 and 1960. The samples were collected in Denmark.

Data are tabulated. Results are compared with Sunshine Unit values and with values on similar measurements in the United States. (C.H.)

8452 PRACTICE OF GONADAL PROTECTION IN X-RAY STUDY OF HIP JOINTS OF INFANTS. S. Nakagawa and S. Antoku (Hiroshima Univ.). Hiroshima Igaku, 13: 945 (1960).

In phantom experiments, measurements were made on the gonadal dose in x-ray examination of the hip joint in infants. When protective measures were applied, the gonadal dose was reduced to about $1/14$ in the male and about $1/8$ in the female, as compared with non-protective exposure. The dose reduction rate was about the same level in routine screening and in roentgenophotographic examination. (Abstr. Japan Med., 2: No. 11, Nov. 1962)

8453 MONITORING OCCUPATIONAL RADIATION EXPOSURE IN MEDICINE. Raymond E. Parks (Univ. of Miami, Fla.). Ind. Med. Surg., 31: 284-6(July 1962).

The personnel dosimetry of medical workers is discussed in the light of modern protection standards for both controlled and uncontrolled individuals. The advantages, as well as the disadvantages, of the use of pocket ion chambers and film badges for the surveillance of this type of radiation problem is reviewed. The authors conclude that the film badge offers the best approach to this type of personnel dosimetry. (Public Health Engineering Abstracts, 42: No. 10, Oct. 1962).

8454 ISOTOPE BOX FOR THE AUTOPSY OF DEAD BODIES CONTAINING RADIOISOTOPES. O. Keim and G. P. Wildner (Universität, Berlin). Isotopen Tech., 2: 338-40(Nov. 1962). (In German)

The construction on an assembly is described which makes possible the autopsy of dead bodies containing radioactive isotopes, and which protects extensively from radiation. (auth)

8455 Cs-137 CONCENTRATION AND ISOLATION FROM SUPPLY AND RIVER WATER BY THE EXTRACTION OF CAESIUM POLYIODIDES WITH NITROBENZENE. M. Kyrš, L. Holečková, and L. Neumann (Inst. of Nuclear Physics, Czechslovak Academy of Sciences, Řež). Jaderna Energia, 8: 429-31(1962). (In Czech)

The possibilities of Cs^{137} extraction from greater volumes of river and supply waters with nitrobenzene solution of polyiodides were investigated. Advantages of the proposed method are compared with previously described methods. (P.C.H.)

8456 RADIOACTIVE FALLOUT. ITS SIGNIFICANCE FOR THE PRACTITIONER. C. L. Dunham (Div. of Biology and Medicine, AEC). J. Am. Med. Assoc., 183: 136-9 (Jan. 5, 1963).

The characteristics of radioactive fallout are reviewed and factors affecting the biological availability of fission products for man are discussed. It is pointed out that fallout may result in exposure of the whole body from external sources or exposure from radioactive elements that have gained access to the body. The principal sources of external exposure are the short-lived fission products of iodine and $Zr-Nb^{95}$ and $Ba-La^{140}$ and the longer-lived Cs^{137}. Because of its energetic γ rays, Cs^{137} also produces whole-body exposure when taken into the body. It is relatively uniformly distributed in the body muscle mass and is retained in the body with a biological half-life of about 110 days. Approximately 90% of the total body and genetically significant dose to the present generation is from these sources. Strontium-90 emits only β rays so contributes very little to this, but because it behaves metabolically much like Ca it tends to accumulate in bone where it irradiates both bone and adjacent bone marrow. $Cesium^{137}$ and Sr^{90} are present in all of our principal foods, though both are relatively quite low in fish and sea foods. $Iodine^{131}$ is present in food only periodically during active atmospheric testing or locally at the time of accidental release from atomic energy plants. $Carbon^{14}$ from weapons tests contributes only a small amount of radiation to the total-body dose. It does contribute significantly to the cumulative exposure of the germ cells over many generations. Data are summarized on estimated radiation doses in the U. S. from natural background and from fallout through 1961 and the estimated effects of fallout on the number of gross physical or mental defects in future generations in the U. S. The estimates for cases of leukemia and bone cancer induced by fallout to date range from 0 to 2,000 and 0 to 700 respectively during the next 70 years, with the risk ranging from 0 to 1/100,000 for leukemia and 0 to 1/300,000 for bone cancer. (C.H.)

8457 RADIOLOGIC MONITORING OF GROUND WATER AT THE HANFORD PROJECT. Donald J. Brown and John R. Raymond (General Electric Co., Richland, Wash.). J. Am. Water Works Assoc., 54: 1201-12(Oct. 1962).

The waste disposal policy established at Hanford to safeguard the human population and the environment in this region has been maintained at a high level of confidence. Results of a well organized monitoring program provide the primary basis for assessing the present and continued safety of the radioactive liquid waste ground disposal operations. Since the beginning of disposal operations significant strides have been made in increasing the knowledge of ground water flow beneath the project and in developing equipment and methods for determining the status of radiocontaminants in the ground water more accurately. It is expected that much of Hanford's work will be of assistance in establishing and evaluating ground water monitoring procedures at future plants as they are constructed and integrated into the atomic energy industry. (auth)

8458 REMOVING RADIOSTRONTIUM FROM MILK. CURRENT STATUS OF A PILOT PLANT PROCESS. L. F. Edmondson, H. E. Walter, A. M. Sadler, F. P. Hanrahan, D. G. Easterly, J. Y. Harris, D. H. Keefer, and A. R. Landgrebe. J. Dairy Sci., 45: 800-3(June 1962).

An interim report is presented on the present status of pilot plant research on the removal of strontium-90 from milk, a cooperative effort by the U. S. Department of Agriculture, the U. S. Atomic Energy Commission, and the Public Health Service of the Department of Health, Education, and Welfare at the Beltsville Laboratory, and the Robert A. Taft Sanitary Engineering Center. The process is based on the ion-exchange principle. Milk contaminated with radiostrontium is passed through a bed of synthetic resin charged with a mixed solution of metallic ions which are present in milk. As the milk passes through the column, the stronium ions in the milk change places with the metallic ions on the resin. About 90% of the radioactive strontium can be removed. Cost of treatment and processing varies from 2 to 5 cents per quart, the efficiency of the process being closely related to the amount of milk that can be passed through a column before the column becomes exhausted. The process is summarized as to charging the resin bed, acidification of the milk, putting the milk through the column, neutralizing the milk, processing the treated milk, cleaning and sanitizing the resin, and regeneration of the resin. Experiments have been based on experimental use of milk obtained from a cow fed measured doses of radiostrontium. Work is now in progress at the Beltsville Laboratory to apply the

techniques to the removal of environmental levels of strontium. (Public Health Engineering Abstracts, 42: No. 10, Oct. 1962).

8459 RADIOACTIVITY OF RAINWATER. B. S. Sood and A. K. Talwar (Panjab Univ., Chandigarh, India). J. Sci. Ind. Res. (India), 21B: 595(1962).

The gross radioactive content of some samples of rainwater collected at Chandigarh during March-August 1962 has been estimated using an end window Geiger counter. The activity of the samples collected during July-August is weaker compared to that of samples from March-June. (auth)

8460 CONTAMINATION AND DECONTAMINATION OF SURFACES. (SUMMARY REPORT). H. F. Moldenhawer (VEB Entwicklung und Projektierung Kerntechnischer Anlagen, Berlin). Kernenergie, 5: 585-600(Aug. 1962). (In German)

A literature survey is given of the contamination and decontamination of surfaces. The topics discussed are theory and measurement methods, surface requirements and selection of surface materials, decontamination methods, and the most important decontamination media. 62 references. (J.S.R.)

8461 INVESTIGATIONS ON A "HOT" PARTICLE FROM AN ATMOSPHERIC AEROSOL. K.-F. Poulheim (Institut für Staubforschung und Radioaktive Schwebstoffe, Berlin). Kernenergie, 5: 675-7(Sept. 1962). (In German)

Measurements on a hot particle, found on the filter band of an air monitor, were discussed. The particle was autoradiographed and qualitatively and quantitatively analyzed, and its dose output in biological tissues was theoretically evaluated. (tr-auth)

8462 THE EXAMINATION OF URINE IN THE CONTROL OF EXPOSURE TO EXTERNAL AND INTERNAL IRRADIATION. E. Bazzano (Centro Informazioni Studi Esperienze, Milan), C. Garavaglia, and E. Ghislandi. Med. Lavoro, 53: 291-304(1962). (In Italian)

The use of urine analysis to keep a check on exposure to external and internal irradiation is described; it is employed particularly in the case of workers in nuclear plants and laboratories. The examination comprises radiochemical and biochemical analyses. The former consists in the determination of natural and artificial radionuclides eliminated by the kidney. Sample collection and the frequency of analyses are considered. The value of urine analysis in the estimation of total body radioactivity is discussed and a brief survey of available methods is given, the use of chelating substances being mentioned in particular. The biochemical analysis comprises both qualitative and quantitative estimations of those metabolic products which are an index of damage by ionizing radiations; these are mainly products derived from the breakdown of proteins and of nucleic acids and some enzymes. Special attention is paid to albuminuria caused by uranium intoxication, to alterations in aminoaciduria, and to the elimination of nucleic acid metabolites. (122 references.) (auth)

8463 STRONTIUM-90: DANGER AND DETERMINATION IN BONES OF LIVING HUMAN BEINGS. C. Cappadona, F. D'Angelo, and L. Dardanoni (Università, Palermo, Italy). Minerva Nucleare, 6: 208-12(July-Aug. 1962). (In Italian)

The concentrations of Sr^{90} and Y^{90} were determined in 35 specimens of bone from patients with fractures or during surgical operations. In most cases, the values observed in this series were similar to those reported by other workers in various other countries, with a slight increase as compared with the mean values for the past few years. In some instances, exceptionally high values were observed, supporting the "hot spot" theory, i.e. that the distribution of Sr^{90} in the skeleton is uneven. (auth)

8464 REQUIREMENTS FOR TRAINING IN FIRST-AID AND HOSPITAL PROCEDURES. Alvan Sach-Rowitz. Minn. Med., 44: 268-73(July 1961).

Organization and training activities for medical care of casualties resulting from a nuclear attack are discussed. The training of lay individuals in first-aid and simple hospital procedures to assist trained medical personnel is recommended. (H.H.D.)

8465 HOW TO PROTECT HOSPITALS FROM FALLOUT. Mod. Hosp., 98: 69-74(Jan. 1962).

Means of incorporating fallout safeguards in existing hospitals and new ones are discussed from an architectural viewpoint. (H.H.D.)

8466 HOW TO KEEP FALLOUT OUT OF AIR AND WATER. Mod. Hosp., 98: 109-14(Jan. 1962).

Ways for protecting hospital water supply and ventilation systems from contamination by fallout after a thermonuclear attack are considered. (H.H.D.)

8467 HOW GREAT IS THE DANGER OF IRRADIATION BY LUMINOUS DIALS OF WRIST WATCHES? J. Zellweger. Muench. Med. Wochschr., 103: 2553(Dec. 29, 1961). (In German)

It was found that the most hazardous aspect of this source of radiation is accidental breakage of the watch crystal and unwitting contamination of the person who attempts to remove the broken glass. (H.H.D.)

8468 MICROSCOPIC EXAMINATION OF HIGHLY RADIOACTIVE FALL-OUT PARTICLES. T. Mamuro, A. Fujita, T. Matsunami, and K. Yoshikawa (Radiation Centre of Osaka Prefecture). Nature, 196: 529-31(Nov. 10, 1962).

A summary is presented of results of microscopic and radiometric observations on highly radioactive fallout particles collected in Japan several weeks after the Russian nuclear test explosions of October 1961. The particles were isolated and immersed in a very small drop of cedar oil, and photomicrographs made. Data on particle diameter, color, shape, and activity are compared with the photomicrographs. (C.H.)

8469 REMOVAL OF RADIOSTRONTIUM FROM MILK. A. Aarkrog and H. C. Rosenbaum (Danish Atomic Energy Commission, Research Establishment, Risø, Roskilde, Denmark). Nature, 196: 767(Nov. 24, 1962).

A laboratory procedure is described for the removal of 99.7% of radiostrontium from milk. The batch method uses 3 treatments of the milk with cation exchange resin. One l of milk is mechanically stirred for 20 min with 50 g of Dowex 50 W-X8 resin in potassium form plus 5 g of the resin in hydrogen form. After stirring, the resin is removed by filtration and the filtered milk is treated once more for 20 min with fresh portions of 50 g potassium resin and 5 g hydrogen resin. The milk is filtered and stirred for 20 min with the resin in the calcium form plus 5 g resin in hydrogen form. The used resin is washed in water with detergent, sterilized with hot diluted HNO_3, and transferred to a column for conversion to the sodium form by passing strong NaCl solution through the column. The sodium resin is transferred to potassium resin, calcium resin, or hydrogen resin in three different columns by passing a KCl, a $CaCl_2$, or a HCl solution, respectively, through the sodium resin beads. The taste of the treated

milk is good and a taste panel of 20 persons failed to distinguish any significant difference between treated and untreated consumer milk. (C.H.)

8470 EXTERNAL EXPOSURE FROM THE CONING RADIOACTIVE CLOUD IN THE VICINITY OF RELEASE POINT. Toshinori Iijima and Ichiro Miyanaga (Japan Atomic Energy Research Inst., Tokyo). Nippon Genshiryoku Gakkaishi, 4: 741-5(Nov. 1962). (In English)

The immersion model based on the meteorological dispersion of the cloud cannot be applicable to the estimation of exposure dose near the release point. And it is also important to estimate the exposure of personnel in site of the reactor, and results of the estimation would be useful to know the exposure pattern of Ar^{41} which is released in normal operation of the reactor. The estimation was made of the external dose near the release point, comparing with those in immersion case, and the aspect of external dose from radioactive cloud in whole area of interest was figured out. The calculation was carried out under the following assumptions: (1) The cloud is of the coning shape with a vertex angle 20° which corresponds to category D (stable) in Meade and Pasquill's classification. (2) The condition of continuity of radioactivity holds and the distribution of the radioactive concentration is Gaussian in the radial direction of the cross section of the cloud. The results show that the external dose near the release point from the coning cloud is in the same order as the maximum dose in immersion case and never exceeds it. Figures were given showing the effect of variation of release point height and iso-dose distribution near the release point. The error resulting from some simplifications of the original equation was within 10%. (auth)

8471 HOW HAZARDOUS IS DENTAL ROENTGENOGRAPHY? Albert G. Richards (Univ. of Michigan, Ann Arbor). Oral Surg., Oral Med., Oral Pathol., 14: 40-51 (Jan. 1961).

A search was made of dental and medical literature to determine the various clinically proven biologic effects that x radiation can produce in the human body, the amount of radiation necessary to produce effects in the various tissues, and the amount of radiation that reaches the tissues when dental examinations are made with x rays. From this, the degree of hazard associated with dental x-ray examinations was assessed. A survey of the past 40 years failed to disclose any clinical evidence that would seriously condemn the practice of dental roentgenography when used in an intelligent manner, as being unsafe for either patient or dentist. No instances of burns or malignancy from dental diagnostic x-ray procedures have been reported. The few documented incidents of untoward biologic effects that occurred in the past when dental patients were exposed to larger amounts of x radiation are less likely to be repeated among patients today because of the far smaller amounts of x radiation that presently are employed. A statistical study of the longevity of dentists indicated that dentists live almost 3 years longer than white nondentists, thus the dentist's life expectancy has not suffered either because of occupational exposure to radiation. (H.H.D.)

8472 BASIC PRINCIPLES AND USEFUL NUMERICAL DATA CONCERNING PROTECTION AGAINST IONIZING RADIATIONS. P. Pizon. Presse Med., 69: 2101-4 (Nov. 4, 1961). (In French)

Admissible doses to humans of various types of radiation are discussed. (H.H.D.)

8473 RECENT DEVELOPMENTS IN MINIMIZING RADIATION EXPOSURE IN DIAGNOSTIC PROCEDURES. Wendell G. Scott. Proc. Inst. Med. Chicago, 23: 321-7 (Nov. 15, 1961).

Data obtained by surveys of roentgenographic devices in the United States are reviewed, with particular regard to hazards encountered, safety factors now employed, and recommendations for minimizing exposure to patients and radiologists. (H.H.D.)

8474 PROTECTION OF CIVILIANS FROM NUCLEAR RADIATION. M. Van Camelbeke. Rev. Praticien, 12: (8), Suppl. v-vii(Mar. 11, 1962). (In French)

Civil defense measures employed by various western nations are discussed. (H.H.D.)

8475 ROUTINE INDIVIDUAL DOSIMETRY IN RADIOLOGICAL PROTECTION AT THE ANTITUBERCULOSIS CONSORTIUM OF MILAN. M. Belli and B. Perotti. Rev. Tuberc. (Paris), 25: 1147-52(Sept.-Oct. 1961). (In French)

Radiologic protection techniques employed during diagnostic roentgenography of tuberculous patients are discussed. (H.H.D.)

8476 RADIATION PROTECTION OF PATIENTS. A. Zuppinger (Universität, Bern). Schweiz. Med. Wochschr., 91: 1221-6; 1250-4; 1319(1961). (In German)

Possible injury to patients receiving diagnostic or therapeutic radiation is reviewed. From a consideration of the more severe genetic sequelae, it is concluded that a dose of 100 r doubles the natural mutation rate. In 1957 the genetically significant dose for diagnostic radiation was 22.3 mr in Switzerland. It is felt that this dose can be halved without impairing the information gained for diagnostic purposes. (H.H.D.)

8477 THOUGHTS ON THE INFLUENCE OF SAFETY MEASURES TO THE COSTS OF ATOMIC ENERGY PLANTS. Guenter Wiesenack. Tech. Ueberwach., 3: 466-9(Dec 1962). (In German)

The effects of safety measures on the costs of atomic energy plants are discussed. However, it is felt that excessive safety measures are understandable and necessary until sufficient fundamental scientific and working knowledge allows their gradual reduction. (P.C.H.)

8478 DESCRIPTION OF A TECHNIQUE FOR MEASURING ATMOSPHERIC RADIOACTIVITY AND FOR SEPARATING RADIOACTIVE AEROSOLS. V. J. Lenger. Zdravotni Tech. a Vzduchotech., 4: No. 2, 55-61(1961).

The layout of an apparatus, which is intended for the continuous control of atmospheric radioactivity and also for separating and measuring the concentration of radioactive aerosols and gases from large-scale nuclear plants and hot laboratories is described. The measuring part of the apparatus ensures sufficient sensitivity to determine the maximum admissible concentration of most of the more widespread radioisotopes. Aerosols are separated with polarized electrical filters in the passage of the radioactive medium through special electrical receivers. Polarized electrical filters are made from a porous dielectric (in the form of a glass fabric or a glass fiber packing), containing a spiral or grid-like conductive electrode. If the potential on this electrode is sufficiently high, the surface of the dielectric is polarized and it appears as a very efficient filter for the majority of aerosols that have been previously ionized by an auxiliary field. It is noted that polarized electrical filters present important advantages as compared with similar mechanical, centrifugal, or electrostatic devices. The filters under consideration offer a considerably greater efficiency, a large throughput capac-

ity, a reliable operation in separating both finely and coarsely dispersed media, and are suited for continuous operation. (Referativnyy Zhurnal, Fizika, No. 6, 1962)

8479 RADIATION HAZARDS IN PERSPECTIVE. Third Report of the Expert Committee on Radiation. World Health Organ., Tech. Rept. Ser., No. 248, 37p.(1962).

Radiation hazards are considered in relation to other risks to human populations. It is pointed out that while severe damage and death have followed high-level radiation exposures many more injuries have been described as resulting from a variety of other toxic agents than from radiation. Exposure to low doses of radiation is generally regarded as resulting in hereditary effects, and possibly in cancer and leukemia. Mutagenic effects of toxic substances have hardly been investigated. (C.H.)

8480 PRAKTISCHER STRAHLENSCHUTZ. EINE EINFÜHRUNG IN DIE TECHNIK DES SCHUTZES VOR IONISIERENDEN STRAHLEN FÜR NICHTPHYSIKER. (Practical Radiation Protection. An Introduction to the Techniques of Protection Against Ionizing Radiation for Nonphysicists). D. Frost. Berlin, Verlag Walter de Gruyter & Co., 1960. 194p. D.M. 24.

8481 RADIOACTIVE POLLUTION OF THE ATMOSPHERE. H. P. Jammet (Commissariat a l'Energie Atomique, Paris). p.381-432 of "Air Pollution." New York, Columbia University Press, 1961.

Factors affecting the radioactive pollution of the atmosphere are reviewed. Sources of radioactive contaminants are considered from the viewpoint of quantitative and qualitative aspects of air pollution. The fate of radioactive contaminants present in the atmosphere and the effects of radioactive pollution of the atmosphere on man are discussed. The establishment of maximum permissible doses of radiation for man is considered for somatic and genetic effects. Monitoring methods are described and methods for the prevention of radioactive pollution of the atmosphere are considered. (C.H.)

8482 DIETARY LEVELS OF STRONTIUM-90 AND CESIUM-137. A Summary of World Information. FAO Atomic Energy Series, No. 3. Rome, Food and Agriculture Organization of the United Nations, 1962. 83p. (In English)

Data are presented on the concentration of Sr^{90} and Cs^{137} in food from 1957 to Sept. 1961. Information is included for all countries from which it was available. (C.H.)

8483 VOPROSY BEZOPASNOSTI V URANOVYKH RUDNIKAKH. (Safety in Uranium Mines). V. I. Baranov and L. V. Gorbushina. Moscow, Publishing House of Literature on Nuclear Science and Technology, 1962. 186p.

A survey is given on radiation effects on human organisms and on permissible levels of γ and beta radiations. Dosimetric characteristics of various types of radiation and calculation methods for determining radiation doses from emitters with various configurations are discussed. Safety techniques, dosimetric equipment, and installations for laboratories handling radioactive materials are described. Radiometric sampling, waste disposal, and safety factors in uranium and radon mining are discussed as well as measuring devices for determining air contamination by radioactive aerosols. (R.V.J.)

8484 IONISING RADIATIONS (SEALED SOURCES) REGULATIONS. London, Her Majesty's Stationery Office, 1961. 16p. 9d.

Regulations applying to all factories and precautions to be taken against radiation from sealed sources and apparatus operated at 5 kv or over are specified. Maximum permissible doses that were set are given and adequate shielding is defined. (H.H.D.)

8485 NEUTRON DOSIMETRY AT 500 kev AND 1 Mev. O. I. Leipunskii. IAEA Preprint SM-36/114. 11p. (In Russian)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

The dosimetry and biological effects of <0.5 Mev fast neutrons were determined in previous works. However, the neutron dosimetry and biological effects at >0.5 Mev have not been determined. A paraffin attenuator was used for dosimetry and for measuring thermal neutrons at certain paraffin depths. Resonance indicators or boron filters were used for estimating intermediate neutron doses. The total dose was obtained by combining the intermediate neutron dose with the dose measured with a threshold dosimeter. (R.V.J.)

8486 IMPROVEMENTS IN PORTABLE APPARATUS FOR PROTECTION AGAINST RADIOACTIVE AEROSOLS. Jacques Labeyrie (to Commissariat a l'Energie Atomique). British Patent 911,446. Nov. 28, 1962. Priority date Nov. 5, 1958, France.

A breathing mask for protection against radioactive aerosols is designed with detecting means for instantaneous measurements of the radioactivity. The mask has a filter capable of retaining the aerosols, and the detector is located in or against the filter. (D.L.C.)

8487 WATER TREATMENT. Raymond W. Pitman and Walter R. Conley, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 3,067,133. Dec. 4, 1962.

An automated system for adding clarifying chemicals to water in a water treatment plant is described. To a sample of the floc suspension polyacrylamide or similar filter aid chemicals are added, and the sample is then put through a fast filter. The resulting filtrate has the requisite properties for monitoring in an optical turbidimeter to control the automated system. (AEC)

8488 SHIPPING CONTAINER FOR RADIOACTIVE MATERIAL. H. D. Nachbar, B. B. Biggs, P. J. Tariello, and K. O. George (to U. S. Atomic Energy Commission). U. S. Patent 3,073,961. Jan. 15, 1963.

A shipping container is described for transporting a large number of radioactive nuclear fuel element modules which produce a substantial amount of heat. The container comprises a primary pressure vessel and shield, and a rotatable head having an access port that can be indexed with module holders in the container. In order to remove heat generated in the fuel elements, a heat exchanger is arranged within the container and in contact with a heat exchange fluid therein. The heat exchanger communicates with additional external heat exchangers, which dissipate heat to the atmosphere. (AEC)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

8489 (AERE-R-3704) MEASUREMENT OF LEAKS IN HERMETICALLY SEALED CONTAINERS USING ^{85}Kr. P. F. Berry and J. F. Cameron (United Kingdom Atomic Energy Authority. Research Group. Wantage Research Lab., Wantage, Berks, England). Nov. 1962. 33p.

Two methods of using Kr^{85} for leak detection are described. In the first method the containers are immersed in Kr^{85} at a high pressure and during the immersion period gas is forced into those which leak. These are then removed and monitored individually for radioactive content. Leak rates as low as 10^{-11} standard ml/sec have been measured in this manner. Large numbers of small volume containers such as transistor encapsulations and thermionic valves are most readily inspected by this technique and its application to transisted quality control is discussed in detail. Some of the difficulties associated with the method, such as misinterpretation of very small leak rates due to surface contamination and of very large leak rates due to loss of gas before monitoring, are also considered. In the second method a small quantity of the gas is inserted before the final seal is made. A leak is detected by placing the container in a chamber which is evacuated and then isolated. Gas which leaks out is collected and pumped into a counter and from the counting rate the leak rate is calculated. The method is most attractive for leak testing small numbers of large volume, thick walled containers such as pressurized vessels and reactor fuel elements. A comparison is made with the helium mass spectrometer and it is concluded that the Kr^{85} method is cheaper, simpler, more reliable, and in some cases more sensitive. (auth)

8490 (BMI-1606) STUDIES OF ON-STREAM PRODUCTION OF SHORT-LIVED INTRINSIC RADIOTRACERS FOR INDUSTRIAL PROCESS CONTROL. Peter Gluck, James L. McFarling, John F. Kircher, Charles W. Townley, and Duane N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Dec. 18, 1962. Contract W-7405-eng-92. 56p.

It was demonstrated that isotopic neutron sources can be employed in the production of short-life radioactive tracers for use in industrial process control. The characteristics of Po–Be neutron sources were investigated for this application. Such factors as the effects of activation-cell geometry, the use of moderators, salt concentrations, and the effective neutron fluxes were evaluated. Flow studies were performed for several elements and activation efficiencies were determined. Guidelines were established to enable a process engineer to evaluate the feasibility of employing intrinsic-radiotracer process control. Several examples of this type of an evaluation were presented. (auth)

8491 (NYO-10412) A STUDY OF THE EFFECTS OF SUB-STERILIZATION DOSES OF RADIATION ON THE STORAGE LIFE EXTENSION OF SOFT-SHELLED CLAMS AND HADDOCK FILLETS. Final Summary, May 1961–May 1962. John T. R. Nickerson, Samuel A. Goldblith, and Edmund B. Masurovsky (Massachusetts Inst. of Tech., Cambridge). Dec. 1962. Contracts AT(30-1)-1219 and AT(30-1)-3006. 84p.

Methods for bacterial counts on soft-shelled clams and haddock were evaluated. A bacteriological evaluation was made of the product from 3 clam-shucking plants and from 3 haddock-filleting plants over a 2-month period. Data were analyzed statistically and critically evaluated for commercial and sanitary significance. The effects of exposure to various doses of γ radiation from a Co^{60} source on storage life was evaluated. Results indicate that haddock fillets exposed to 700,000 to 800,000 rad γ radiation can be maintained under refrigeration for 2 to 3 mo. Shucked, soft-shelled clams appear to be effectively preserved for periods up to 3 mo when stored at 0°C after exposure to doses of 650,000 to 800,000 rad of Co^{60} γ rays. (C.H.)

8492 (TID-7640) ISOTOPE TECHNOLOGY DEVELOPMENT PROGRAM FOURTH ANNUAL CONTRACTORS MEETING CONDUCTED AT OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE, DECEMBER 3–4, 1962. (Oak Ridge National Lab., Tenn.). Contract [W-7405-eng-26]. 88p.

Forty-two papers presented at the Isotope Technology Development Program Fourth Annual Contractors' Meeting are given. Topics covered include: activation analysis, radiometric analysis, low-level tracer process control, radiation absorptiometry, radioisotope fluid dynamics, ionization technology, nondestructive testing, isotope measurement systems, isotopic heat, and safety testing. (M.C.G.)

8493 PRACTICAL APPLICATIONS OF HIGH-SENSITIVE GAMMA-RELAYS. M. Yu. Borukhov and B. K. Mal'tsev. Tr. Tashkentsk. Konf. po Mirnomu Ispol'z. At. Energii, Akad. Nauk Uz. SSR, 2: 32-6(1960).

Discussion is given on the principle of gamma relays and their practical applications, such as level control of loose materials, location of cable joint after vulcanization of sheath, and process control in hydraulic dust removal from ore during its belt transportation to the crusher. (P.C.H.)

8494 INDUSTRIAL STERILIZATION BY GAMMA RADIATION. G. S. Murray (Gamma Sterilization Pty. Ltd., Victoria, Australia). At. Energy, 5: No. 4, 2-6(Oct. 1962).

The primary purpose of the plant is the disinfection of imported animal fiber used in carpet manufacture, as required by quarantine regulation. However, the facility is being used increasingly for the sterilization of hospital supplies and pharmaceuticals. The stream of packages to be processed is circulated around a Co^{60} radiation source. (R.J.S.)

8495 EXPERIENCE IN PHYSICAL AND TECHNOLOGICAL EXAMINATIONS OF IRRADIATED FRUITS AND FRUIT JUICES. Th. Tuchscheerer (Bundesforschungsanstalt für Lebensmittelfrischhaltung, Karlsruhe, Ger.). Atompraxis, 8: 458-63(Dec. 1962). (In German)

Optical constants, especially changes in uv permeability, were studied in irradiated grape juice and peaches. The radiation-dependent formation of a clearly defined absorption band for grape juice at 2650 Å is a very sensitive criterion of radiation change. A closer analysis of the uv band for grape juice revealed that it is a pure sugar band. Comparative studies with various sugar solutions showed that the position of the bands in the spectrum can be accurately verified if the composition of the sugar solution matches the concentration of the sugar components of the grape

juice. As for irradiation of whole fruits, peaches were used as an example to show that enough original material must be irradiated in order to avoid distortion of the measurement by biological scattering in the irradiation material. (auth)

8496 INDUCED RADIOACTIVITY FOR COARSE COPPER-ORE CONCENTRATION. A. M. Gaudin (Massachusetts Inst. of Tech., Cambridge) and Harald F. Ramdohr. Can. Met. Quart., 1: 173-85(Oct.-Dec. 1962).

Thermal neutron radiation is used to induce radioactivity in Cu ore. Counting methods were studied to distinguish between particles of different Cu content. The construction and operation of a free-fall sorting device employing a scintillation counter and flipping gate are described. (R.J.S.)

8497 ELECTRON PARAMAGNETIC RESONANCE AND BAKING STUDIES ON GAMMA-IRRADIATED FLOUR. C. C. Lee (Univ. of Saskatchewan, Saskatoon). Cereal Chem., 39: 147-55(Mar. 1962).

The irradiation of flour (from Western Canadian hard red spring wheat) at its usual moisture level of 12 to 14% with up to 10^6 rads of Co^{60} gamma rays gave no observable electron paramagnetic resonance (EPR) spectrum. However, after reduction of the moisture content to 8 or 4%, irradiation resulted in EPR absorption indicating presence of radioinduced free radicals, which were destroyed rapidly in the presence of water vapor. With the irradiated flour kept in a sealed tube, the EPR spectrum faded with time. The fading was quite rapid for the first few days and then proceeded more slowly. Irradiation resulted in a moderate increase in baked bread loaf volume at fairly low radiation dosages, followed by a gradual decrease in loaf volume at higher dosages (0.25 Mrad). Also, loaf volume tended to decrease as the elapsed time between irradiation and baking increased. This finding, when considered with the fading of the EPR spectrum, indicated that the EPR-detectable free radicals in the irradiated flour did not cause a strengthening of the gluten to produce an increase in loaf volume, as the radicals disappeared on becoming stable compounds. (H.H.D.)

8498 THE EUROPEAN FOOD IRRADIATION PROGRAM. Kevin G. Shea (U. S. Atomic Energy Commission, Washington, D. C.). Food Technol., 16: No. 6, 20-2(June 1962).

A survey was made during Sept. 1959 through Mar. 1960 to determine the number and quality of personnel engaged in food irradiation, the commitment of laboratory facilities, and future plans. The results of the survey and some recent information on European research programs and facilities are summarized. The study showed that the number of people engaged in full or part-time research on the technology of food irradiation, including wholesomeness studies, in any given country does not exceed 20. With some exceptions, basic rather than applied research has been stressed. As a result of the survey, it was concluded that a cooperative program is desirable. Such a program would use expanded radiation sources presently available for national research programs, or would possibly result in a new center. Programs of individual countries are discussed, including those of France, Denmark, Holland, Germany, Sweden, Norway, Portugal, Spain, Italy, Belgium, and Austria. (H.H.D.)

8499 INFLUENCE OF IRRADIATED BACON LIPIDS ON BODY GROWTH, INCIDENCE OF CANCER, AND OTHER PATHOLOGIC CHANGES IN MICE. Margaret S. Dixon, Dean L. Moyer, Louis J. Zeldis, and Ralph W. McKee (Univ. of California, Los Angeles). J. Food Sci., 26: 611-17(Nov.-Dec. 1961).

For 3 months mice (757) were fed diets containing uncured bacon, irradiated with 5.58 megarad of gamma rays, or uncured unirradiated bacon. There were no major differences between the control and experimental groups. No gross or histopathological lesions attributable to irradiation of the lipid were observed. The incidence of spontaneous cancers showed no significant differences among the diet groups and indicated that irradiation of the bacon did not produce carcinogens or growth-altering substances demonstrable under the conditions of the experiments. No significant differences between the degree of unsaturation and peroxide numbers of irradiated and unirradiated bacon lipid was found. Storage of the bacon lipid at room temperature for up to 2 months resulted in a higher peroxide number for the irradiated lipid. (H.H.D.)

8500 RADIATION STERILIZATION OF FOOD. II. SOME ASPECTS OF THE GROWTH, SPORULATION, AND RADIATION RESISTANCE OF SPORES OF CLOSTRIDIUM BOTULINUM, TYPE E. C. F. Schmidt, W. K. Nank, and R. V. Lechowich (Continental Can Co., Inc., Chicago). J. Food Sci., 27: 77-84(Jan.-Feb. 1962).

The radiation resistance of spores of 6 strains of Type E C. botulinum in beef stew was determined. The results were evaluated in terms of the minimum dose showing no spoilage for a 2 billion total inoculum level (20 cans each with 100 million spores per can) and in terms of a calculated radiation D value. The mean radiation D value for 6 strains was 0.132 megarad (range 0.125–0.138). A comparison with results for 6 strains of Type A and 5 strains of Type B showed that Type E strains possessed about 45–55% of the resistance to ionizing radiation of Types A and B. It was concluded that any radiation dose for food sterilization based upon the maximum resistance of Type A or B strains would provide ample protection against Type E strains. The unswelled cans at the lowest radiation level showing no spoilage were free of toxin and recoverable Type E spores. (H.H.D.)

8501 RADIATION RESISTANCE OF SPORES OF TYPE E CLOSTRIDIUM AS RELATED TO EXTENSION OF THE REFRIGERATED STORAGE LIFE OF FOODS. C. F. Schmidt, R. V. Lechowich, and W. K. Nank (Continental Can Co., Inc., Chicago). J. Food Sci., 27: 85-9 (Jan.-Feb. 1962).

Spores of 3 strains of C. botulinum Type E were inoculated into cans of beef stew and irradiated with 0.25 to 1.0 Mr to permit survival of a small number (50–250) of spores per container. The cans containing survivors were incubated at 43 and 49°F to determine whether germination and out-growth of surviving spores could take place. With all 3 strains at least some of the survivors were capable of developing to the point of producing swell spoilage and toxin at both temperatures. The results show that a few spores surviving dose levels in the radiopasteurization range were capable of germinating and producing toxin at low temperatures within storage periods not excessively long in relation to some estimates of extended refrigerated storage life. (H.H.D.)

8502 EFFECTS OF FEEDING A VITAMIN K-DEFICIENT RATION CONTAINING IRRADIATED BEEF TO RATS, DOGS, AND CATS. Elwood F. Reber and Om P. Malhotra (Univ. of Illinois, Urbana). J. Nutr., 74: 191-3 (July 1961).

A ration containing 35% beef irradiated with 2.79 megarad fed to 12 male Sprague-Dawley rats caused the death of 9

rats because of hemorrhage. The mean reciprocal of the prothrombin time was 0.068 ± 0.018 sec^{-1}. When 3 male cats and 3 male dogs were fed a ration containing irradiated beef for 40 weeks, all gained weight and the prothrombin time of the blood remained normal. The amount of vitamin K in the ration was calculated to be 6 μg/100 g of ration solids, which was adequate to prevent prolonged prothrombin times of the blood of cats and dogs, although it was inadequate for rats. Irradiation of beef with 2.8 megarad was previously shown to cause a 50–85% loss in vitamin K content. Rats fed a ration containing nonirradiated beef survived and there was no prolonged prothrombin time of the blood. (H.H.D.)

8503 THE PRESERVATION OF PERISHABLE FOODSTUFFS BY EXPOSURE TO RADIATION. Pierre Vidal. Mem. Soc. Ingrs. Civils France, 114: No. 12, 29-41(Dec. 1961).

The main fields of application for radiation dosages required from 100 to 10^6 rad are discussed in detail, including the biological action of ionizing radiation on both foodstuffs and parasites. The nontoxicity of irradiated foods is emphasized. The most difficult problem is overcoming changes, which adversely affect the acceptability, in the organoleptic properties, texture, odor, and the appearance of irradiated foodstuffs. A combination of irradiation and heat or cold treatment may be the solution in many cases, or low level irradiation may prove to be adequate for preserving completely the quality and the nutritional value of foodstuffs. Economic factors of food irradiation are considered, and the advantages of food irradiation as compared to other food preservation methods are enumerated. (OID)

8504 STERILIZATION BY IONIZING RADIATION. Torgil R. Moller. Nord. Hyg. Tidskr., 42: 193-216(1961). (In Swedish)

The effects of ionizing radiations on microorganisms and on solutes in dilute soultions are reviewed. The use of x radiation in sterilizing foods, drugs, and other biological materials is also discussed. (H.H.D.)

8505 COBALT-60 IRRADIATION PLANT. Nucl. Power, 7: 50-2(Dec. 1962).

Details are given for a British plant in which disposable plastic syringes used by hospitals can be sterilized by gamma irradiation from a Co^{60} source without subjection to heat. (D.C.W.)

8506 COMMERCIAL STERILIZATION WITH COBALT-60. Gordon S. Murray (Gamma Sterilization Pty. Ltd., Dandenong, Australia). Nucleonics, 20: 50-1(Dec. 1962).

An Australian radiation-processing plant sterilizes animal fibers and medical equipment economically with gamma radiation from ~500,000 curies of cobalt-60. (auth)

8507 RADIATION RAILWAY SIGNALS WITH RADIOISOTOPES LOCATED ON GROUNDS AND THEIR MECHANISMS OF FAIL-SAFE OPERATIONS. Akira Kobayashi (Railway Technical Inst., Japan National Railway). Radioisotopes (Tokyo), 11: 344-9(Nov. 1962). (In Japanese)

Preliminary tests on radiation-interruption type railway signals were carried out. These are applicable as train-detectors when the radiation is traversing over the track and as axle-counters when the γ rays are traversing just over the head of rail. A train detector with bremsstrahlung from Kr^{85} and gamma-axle-counters seemed to be most promising. Next the fail-safe mechanism of gamma electronic relay aimed for a radiation cab-signal, in which a radioisotope is buried along tracks and the detector is installed on a train, was developed. This mechanism includes a special pulse circuit called a choking circuit, which consists of a C·R pulse integrator followed by a "Schmitt Trigger." Normally this "Trigger" is always making flip-flop actions through integrator's ripple voltage caused by a G-M tube background pulses. This pulsive power activates the auxiliary relay, indicating all circuit including a G-M tube to be in a good condition. In the case of G-M tube or circuit failures this auxiliary relay drops away. When the signal radiation is reached, the high intensity radiative pulses drive a Schmitt Trigger continuously in a trigged state. In this state, the normally conducting signal-relay current is cut off, and then the signal relay drops away indicating a warning state. Through adequate combinations with the signal and auxiliary relay contacts, the fail-safe relay system was accomplished. (auth)

8508 USE OF GAMMA RAYS IN MEASURING WATER CONTENT AND PERMEABILITY IN UNSATURATED COLUMNS OF SOIL. C. G. Gurr (C.S.I.R.O., Adelaide). Soil Sci., 94: 224-9(Oct. 1962).

A technique for using gamma rays for measuring water content in columns of soil is described. Equations connecting gamma ray counting rates with soil density and water content are developed, from which water contents may be calculated in a column of soil once a preliminary measurement at a known water content and bulk density has been made. Some results of unsaturated permeability measurements made with this method are presented. (auth)

8509 THE POSSIBILITY OF USING LARGE RADIATION SOURCES IN INDUSTRY. I. INDUSTRIAL PLASTIC MATERIAL. Zorica Draganić. Tehnika (Belgrade), 17: 241-240(1962).

The possibilities of using ionizing radiation in the plastics industry were studied. Details were obtained on the possibilities of radiochemical polymerization and on the results of polymer grafting. The modification of polymers, induced by ionizing radiation, was also considered. (OID)

8510 PRESENT STATUS AND THE FUTURE DEVELOPMENT OF RADIOTECHNOLOGY. Dušan Stanković. Tehnika (Belgrade), 17: 137-45(1962).

Discussion is given on the uses of ionizing radiation in technology and for preserving various agricultural and other products, the present status and development of the fruit and vegetable industry in Yugoslavia, and problems of utilizing large quantities of fruit, grapes, and vegetables, which spoil and involve great losses. The main sources and types of ionizing radiation that can be applied in technology are described, and the effects of ionizing radiation on different organisms, especially those which are responsible for the spoilage of agricultural products, are discussed. Special attention is given to the problems of potato and onion storage, sprouting, and control, and to the storage of similar products, including sugar beets. Favorable effects from ionizing radiation, such as controlling storage pests and meat and egg parasites, increasing the production of penicillin and ergosterol, killing silkworm pupae, improving flour, and improving wine aging are discussed. Several problems and methods of investigation are also discussed. (OID)

8511 CRITICISM OF RADIOACTIVE TOOL LIFE TESTING. N. H. Cook (Massachusetts Inst. of Tech., Cambridge) and A. B. Lang. Preprint Paper No. 62-WA-127. New York, The American Society of Mechanical Engineers, 1962. 5p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

Tungsten carbide and high-speed-steel lathe tool wear tests, carried out by conventional means and by radioisotope techniques, are compared. When the irradiated tool is used to cut under only one set of conditions, good correlation is obtained between the two methods. When the irradiated tool is used under a variety of cutting conditions, correlation is poor. If a single tool is used under different cutting conditions, it is doubtful if differences of less than 2:1 are significant. (auth)

8512 APPLICATION OF ISOTOPE TECHNIQUES IN HYDROLOGY. Technical Reports Series No. 11. A Comprehensive Report from a Panel held in Vienna, November 6-9, 1961. (International Atomic Energy Agency, Vienna). 1962. 34p. STI/DOC/10/11. $1.00(IAEA).

During recent years fractionation effects have been discovered in several stable isotopes present in water which seem promising as tools for obtaining useful hydrological information, especially on the origin of water. Finally, with the discovery of cosmic-ray-produced radioactive isotopes, especially tritium, a method has been found for determining the age of groundwater which is of great value for estimating the age and hence the recharge-rates of groundwater bodies. There is thus, at present, a great variety of isotope techniques available, some of them in the development stage, others more or less ready for application. These various techniques are discussed. (R.J.S.)

8513 PROCESS AND APPARATUS FOR THE IRRADIATION OF WEBS, RIBBONS, OR FILAMENTS. (to Heberlein and Co., A. G.). British Patent 912,229. Dec. 5, 1962. Priority date Apr. 14, 1960, Switzerland.

The material to be irradiated is wound onto a rotatably mounted drum, and rewound upon a similar drum whose axis is parallel to the first drum, and finally wound off from the second drum. A rod-like radiation source is introduced into the interior of each drum prior to the winding of the material thereon. (R.J.S.)

8514 MEASURING SYSTEM. John R. Dukes and Luther Eggman (to Industrial Nucleonics Corp.). U. S. Patent 3,050,626. Aug. 21, 1962.

A system is described to detect the absence of items, cartons, or containers in a sealed case. A number of highly collimated nuclear radiation sources and detectors, each with an individual circuit, are used. (R.J.S.)

INSTRUMENTS AND INSTRUMENTATION

General and Miscellaneous

8515 (AE-97) A FAST TIME-TO-PULSE HEIGHT CONVERTER. O. Aspelund (Aktiebolaget Atomenergi, Stockholm). Dec. 1962. 22p.

A fast time-to-pulse height converter representing a development of Green and Bell's gated beam converter is described. The converter is compatible with 2 input pulses in the stop channel and exhibits excellent linearity and time resolution properties. High stability and large output pulses are obtained by using a large time constant in the converting network. (auth)

8516 (AERE-R-4074) HIGH SPEED TRANSISTOR SCALARS. A. R. Owens, A. J. Cole, and P. E. Dolley (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). June 1962. Regraded Nov. 1962. 35p.

A scalar circuit was improved by using more advanced transistor types. The basic circuit is described. The combination of four basic scalar circuits to make a decade scalar is discussed. The effects of various types of transistors on the resolution are described. Methods are outlined for development of a prescalar system counting from 200 Mc/s downwards. (M.C.G.)

8517 (ANL-6537) ARGONNE DUAL NEUTRON DIFFRACTOMETERS USING A SINGLE PRIMARY BEAM. Report of Metallurgy Program 4.10.5. Melvin H. Mueller, LeRoy Heaton, S. S. Sidhu, and John Terandy (Argonne National Lab., Ill.). Nov. 1962. Contract W-31-109-eng-38. 41p.

Dual neutron diffractometers were designed and built for use at the CP-5 reactor with a number of special features: (1) Two monochromators are used in an in-line arrangement, as suggested by Levy and Peterson, utilizing the same primary beam with two independent diffractometers, one a horizontal instrument and the other a vertical unit. (2) The two monochromating crystals may be used in transmission or reflection, and each crystal may be accurately positioned by external controls. (3) Considerable variations in the wavelength of the primary beam may be made for both diffractometers by changing the take-off angle from the monochromator crystals by means of interchangeable pie-shaped segments. (4) The monochromating crystals are located inside of a relatively small, heavily shielded housing which consists of lead, steel, Boral, and depleted uranium walls which have slotted holes for the exit of two beams, one for the horizontal and the other for the vertical unit. (5) The monochromator housing is surrounded with a large moderating shield which consists of stacked 2-in.-thick Masonite die stock forming a 4-ft cube with a minimum thickness of 2 ft from the inner housing. (6) The detector arm on the horizontal diffractometer pivots about the center of the diffractometer table or may also be made to pivot about a point approximately 2 ft from the center of the table. This arrangement permits the use of the horizontal unit as a diffraction instrument and also as a spectrometer for crystal dynamics studies involving changes of neutron energy. (7) The horizontal table which has optional coupled θ-2θ motion is constructed so as to support massive accessories, such as cryostat, furnace, and magnet. (8) The vertical unit consists of a Picker diffractometer to which is attached the shielded BF_3 detector and a counterbalance. Various specimen supports may be attached including a single crystal device which permits 360° motion in both chi (χ) and phi (ϕ). (9) The movement of the detector arm for both horizontal and vertical instruments may be continuous or incremental by means of the stepping device recently described. (10) Provision is made to read visually and to move three angles independently for both horizontal and vertical units by means of this stepping motor. The intensity and angle are recorded by an x-y recorder and in addition, the intensity versus angle is printed automatically with an IBM typewriter. (auth)

8518 (BNL-6052) EXTINCTION AND DIFFUSE NEUTRON INTENSITY MEASUREMENTS. D. T. Keating (Brookhaven National Lab., Upton, N. Y.) and C. B. Walker (Chicago. Univ. Inst. for the Study of Metals). [1962]. Contract [AT(30-2)-Gen-16]. 11p.

The effects of extinction upon diffuse x-ray measurements is generally ignored. Such effects are important in analogous neutron measurements and may be easily detected by monitoring the transmitted beam. In this case a marked decrease in the transmitted beam is observed when the incident beam suffers a reflection which may not enter the counter. An example and graphical method for predicting all such extinctions is given. It is concluded that for no direction in the crystal is a beam completely free of extinction and a method of correction is suggested which depends only upon the measured transmission. The method is quite simple if the diffraction vector coincides with an even-fold symmetry axis. (auth)

8519 (BNL-6140) A R.F. VERNIER TIME TO PULSE HEIGHT CONVERTER. J. Lowe (Brookhaven National Lab., Upton, N. Y.). Apr. 18, 1962. Contract [AT(30-2)-Gen-16]. 48p.

The electronic measurement of short time intervals in nuclear physics research by use of an r-f vernier method is described. Details of the r-f vernier technique are given along with a discussion of the operation and performance of pulse-height converters with which the technique is used. (J.R.D.)

8520 (BNL-6438) BEAM CURRENT INTEGRATOR. J. Jacobs (Brookhaven National Lab., Upton, N. Y.). Jan. 5, 1962. Contract [AT(30-2)-Gen-16]. 21p. (IHR-112)

The design and operation of a beam current integrator are described, and the theory of operation is discussed. The instrument has two channels. The console channel is designed to measure the accumulation of charge received by a target during a period of a day no matter what the range used in the experimenter's channel. An analysis indicated that this unit will measure the accumulation of charge by a target to an accuracy of 0.1215% assuming that the constant error due to shorting the integrating capacitor is accounted for. The instrument is ranged to handle from 0.5 to 500 μa of beam current. (M.C.G.)

8521 (BNL-6439) SERVO STABILIZED RF VERNIER TIME-OF-FLIGHT ANALYZER. Robert L. Chase (Brookhaven National Lab., Upton, N. Y.). Jan. 15, 1962. Contract [AT(30-2)-Gen-16]. 68p. (IHR-113)

The analyzer can be operated either internally or externally. The 10 ma germanium discriminator is quiescently biased to 6.5 ma in its low-voltage state. An input signal current of 3.5 ma or more triggers it to its high-voltage state. This triggers the oscillator. The oscillator signal is buffered and mixed in the bridge modulator with the reference radiofrequency signal from the cyclotron.

The low-frequency beat note from the bridge modulator is squared up and passed to the beat zero univibrator which generates 0.7 μsec signals each time the beat note passes through zero from positive to negative. The trailing edge of the beat zero univibrator is employed to terminate the time-of-flight measurement and to control the servo measurement. Drawings are included. (M.C.G.)

8522 (BNL-6440) DIGITAL-TO-ANALOGUE CONVERTER (PUNCHED TAPE TO X-Y PLOTTER). G. N. Wall (Brookhaven National Lab., Upton, N. Y.). Jan. 17, 1962. Contract [AT(30-2)-Gen-16]. 39p. (IHR-114)

A digital-to-analog converter is described which is a part of a system that converts punched-tape digital data to analog data in a series of points drawn by an x-y plotter. The converter is designed to plot accurately tapes that contain information other than coded numerical coordinates. Operation of the converter is also described along with format requirements and power supplies. (J.R.D.)

8523 (BNL-6443) 0-2 kv FLASH TUBE SUPPLIES. D. M. Miller (Brookhaven National Lab., Upton, N. Y.). Mar. 15, 1962. Contract AT-30-2-GEN-16. 8p. (IHR-117)

The power supplies designed and constructed to power high-intensity flash tubes are described. Three supplies, capable of charging 100 mfd to 2 kv with a repetition rate of not less than 0.8 sec, are operated remotely from a control panel containing 3 powerstats. The power supplies are full wave center trapped rectifiers employing silicon rectifiers. (M.C.G.)

8524 (GAT-T-927) GRANULAR MATERIAL SAMPLER. C. L. Truman, C. C. Bolt, and W. R. Green (Goodyear Atomic Corp., Portsmouth, Ohio). Sept. 25, 1961. Contract AT(33-2)-1. 5p.

A sampler was designed to provide a random and representative sample of the entire amount of material to be sampled. It is adaptable to various types of granular material such as grain, sugar, salt, flour, coal, and crushed ore. The device is so designed that the granular material will flow by gravity past a baffle system. A representative sample is diverted from the flow and deposited outside the flow system in any suitable container. The sampler consists of a shell composed of two cylinders jointed together by a cylindrical section tapered at 45°. (M.C.G.)

8525 (HW-72644) NONDESTRUCTIVE THICKNESS MEASUREMENT OF END-CAPS ON HANFORD FUEL ELEMENTS. R. L. Brown, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 8, 1962. Contract AT(45-1)-1350. 6p.

Two instruments (ET-5 and ET-6) were developed for measuring the end cap thickness in fuel elements. The instruments are based on the induction of eddy currents in the end cap by a driver coil and the measurement of the eddy currents by a pickup coil; a balance circuit is provided for canceling out the component induced in the pickup coil by the driver coil. (D.L.C.)

8526 (HW-SA-2523) ADVANCEMENTS IN HIGH SPEED SCANNING MONITORING SYSTEMS, HARDWARE AND LOGIC. R. Sherrard (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 6, 1962. Contract [AT(45-1)-1350]. 21p.

A discussion of the design and operational characteristics of a high-speed scanning system is presented. The system performs functions of high-speed data acquisition, monitoring of data for high and low limits including rejection of irradiational values, the display of desired data, and control of the reactor process safety circuit that it is monitoring. (J.R.D.)

8527 (JINR-P-1063) GAZORAZRYADNYI ISKROVOI ELECTRONNO-OPTICHESKII PREOBRAZOVATEL SVETA. (A Photoelectronic Image Intensifier Spark Tube). G. Peter, A. F. Pisarev, and K. M. Fal'brukh (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 8p.

A new type of a photoelectronic image intensifier using gas discharges for application in high-energy physics is considered. The operating characteristics of the device are described. (auth)

8528 (K-1445) AUTOMATIC MASS SPECTROMETER FOR MONITORING URANIUM ISOTOPE CONCENTRATIONS. A. Langdon, E. C. Evans, and C. D. Tabor (Oak Ridge Gaseous Diffusion Plant, Tenn.). Jan. 23, 1963. Contract W-7405-eng-26. 17p.

An automatic recording mass spectrometer has been designed; two instruments have been constructed and have operated reliably for more than seven years as process monitors. Each is fully automatic and capable of making a uranium isotope determination every two and one-half minutes. The results are recorded directly in weight per cent U^{235} with a precision equivalent to that obtained with a manually operated instrument. Provisions have been made to transmit the results to a "slave" recorder and a valve controlling the process. The instruments are of relatively simple circuitry and require no reference standards. (auth)

8529 (LA-2812) AN ABSOLUTE MASS RATE FLOWMETER. F. A. Guevara, R. M. Potter, and W. E. Wageman (Los Alamos Scientific Lab., N. Mex.). Mar. 1959. Contract W-7405-eng-36. 11p.

A true mass flow rate device was developed that is absolute in the sense that it requires no calibration. The flow measurement is made by adding a known amount of energy to a gas and finding its resulting temperature increase. The flowmeter is essentially pressure independent and is capable of 0.1% reproducibility. It is suggested that other versions of this flowmeter should be practical over wide ranges of pressure and temperature and should be usable with a variety of gases and liquids. (auth)

8530 (NP-12485) A VERSATILE FIELD ION MICROSCOPE. S. B. McLane, Jr. and E. W. Mueller (Pennsylvania State Univ., University Park). Dec. 1962. Contract Nonr-656(23). 30p.

An all-metal design of the field ion microscope has proven to be both feasible and versatile. Adaptability, variable magnification, ruggedness, greater safety when used with liquid hydrogen cooling, and high voltage shielding characterize this model. A 6-inch diameter vertical screen, which is easily replaceable, facilitates its use. Application of this model to the study of different screen materials, the use of solid nitrogen cooling, and the study of grain boundaries are described. (auth)

8531 (PAN-333/I-B) X-RAY CAMERA WITH OSCILLATING CRYSTAL AND FILM FOR STUDIES OF SINGLE CRYSTALS. Stanisław Szarras, Lucjan Bońkowski, and Julian Auleytner (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1962. 14p.

An x-ray camera is described for determining the disorientation of mosaic blocks in single crystals. The camera which is furnished with a slit collimator, enables the study of small crystals and very large single crystals. Small specimens are fixed in a special holder whereas large crystals are placed directly on the table of the camera. A driving mechanism performs slow oscillation of the studied crystal. It is also possible to oscillate simultaneously the film holder. The alternative use of a pinhole collimator permits the orientation of single crystals by means of the back reflection Laue method. (auth)

8532 (RT/EL(62)6) SELETTORI DI CANALI. (Channel Selector). A. Mauti and A. Serra (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratorio di Elettronica, Rome). July 1962. 21p.

A selector is described which allows one to record with a Hewlett-Packard 561B printer the data coming from n channels. The selection is given by a system of passive elements coincidences discoupled by diodes. The control system of the selector is a commutator obtained with Philips Z70U gas tubes. (auth)

8533 (RT/EL(62)-13) UN AUTO-OSCILLATORE PULSATO PER MISURE DI TEMPO. (A Pulsed Auto-Oscillator for Measuring Time). A. Massarotti and M. Puglisi (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). June 1962. 9p.

A high-frequency pulsed oscillator is described with the following features: the output is a wave train on low impedance, starting always with the same phase with respect to the starting trigger; the delay between switching off trigger pulse and RF train decay is two or three times the RF period. The device is suitable for exact measurement of delay of the order of magnitude of few nsec between the starting trigger and a single correlated event. (auth)

8534 (SCTM-74-62(13)) THE LONG PERIOD HORIZONTAL AIR BEARING SEISMOMETER. D. F. Wilkes and C. E. Kreitler (Sandia Corp., Albuquerque, N. Mex.). Sept. 1692. Contract [AT(29-2)-789]. 96p.

A long-period horizontal air-bearing seismometer was developed to measure minute earth displacements directly and record them with minimum distortion over a wide range of seismic frequencies. The seismometer is composed of a gravity pendulum coupled to an electrical readout system. Movement of the supporting member in relation to the pendulum mass is measured by the change in electrical capacitance between two plates, one of which is attached to the mass and the second of which is attached to the supporting frame. (M.C.G.)

8535 (TID-17592) CALIBRATION OF THE PR-2 HIGH-ALTITUDE AIR FLOWMETER. Report No. 2347. (General Mills, Inc. Electronics Div., Minneapolis). Oct. 25, 1962. Contract AT(11-1)-401. 15p.

The PR-2 propeller flowmeter has been subjected to tests covering: range of volume flows from 20 to 800 cfm; operating pressure altitudes from sea level to 130,000 ft; and turbulent and laminar flow conditions. These tests, involving several distinctly different standards of comparison, are all in reasonable agreement. They demonstrate that propeller rpm is essentially a linear function of volume flow from 0 to 800 cfm; the instrument is relatively insensitive to density below 100,000 ft; small corrections to the basic calibration will permit use of the instrument at altitudes as high as 130,000 or 140,000 ft; and the consistency of calibration from instrument to instrument is good. (auth)

8536 (TID-17610) INVESTIGATION OF THE PROBLEM OF USING HALL GENERATOR DEVICES FOR REGULATION AND MEASUREMENT OF MAGNETIC FIELDS IN EXPERIMENTAL AREA MAGNETS FOR THE ZGS. G. A. Harasty (Argonne National Lab., Ill.). Aug. 31, 1962. Contract [W-31-109-eng-38]. 38p.

Accurate measurement and stabilization of magnetic fields to 1 part in 10^4 can be achieved through the use of Hall generators. A cursory test and evaluation along with a thorough search of current literature on the state of the art of Hall generator applications provides a sufficient feasibility study to warrant further development of an over-all measurement and control system for the ZGS experimental area magnets. Requirements for such a system are outlined for use of Hall generators as the field sensing devices. The associated circuitry for the Hall generators is discussed and a means for the compensation for temperature effects is given. The laboratory test setup and its purpose are described. The effects of stray nuclear radiation on the semi-conductor element are discussed and recent radiation exposure tests are presented. No definite conclusions about these effects can be made. Physical system design is considered and an outline for further development is given. (auth)

8537 (UCRL-9843(Rev.)) NINE-CHANNEL POLYCHROMATOR FOR OBSERVATION OF TIME-DEPENDENT SPECTRAL LINE PROFILES. George R. Spillman, William S. Cooper, III, and John M. Wilcox (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 22, 1962. Contract W-7405-eng-48. 10p.

The instrument (polychromator) described observes time-dependent spectral-line profiles by simultaneous measurement at nine different wavelengths of light intensity as a function of time. A cylindrical lens magnifies the dispersion of a monochromator and forms an image on a light-pipe holder. Light pipes transfer light from various sections of the image, i.e., different wavelengths, to photomultiplier tubes, and the responses are displayed on oscilloscopes. The instrument was used to look at total wavelength spans of 15 and 20 Å. (auth)

8538 (UCRL-10421) CONCENTRATION AND VELOCITY PROFILES IN A STEFAN DIFFUSION TUBE. Fred J. Heinzelmann, Darshanlal T. Wasan, and Charles R. Wilke (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 16, 1962. Contract W-7405-eng-48. 69p.

The Stefan diffusion tube was widely used as a means of determining vapor-phase diffusion coefficients. By this method the diffusion coefficient was calculated on the assumption of plug-flow (flat) concentration and velocity profiles in the diffusion tube. These assumptions were examined theoretically and experimentally in this study. The theoretical study and the experimental results indicated that the concentration profile is flat across the diffusion tube. The velocity profile was found to be developing from a flat one near the liquid surface to a parabolic one at the other end of the tube. However, it was shown theoretically that the shape of the velocity profile does not affect the mass flux provided the concentration profile is flat. Thus diffusion data that were calculated from Stefan diffusion tube data with the plug flow approximation are correct. (auth)

8539 CANBERRA HOMOPOLAR GENERATOR. L. U. Hibbard (Australian National Univ., Canberra). At. Energy, 5: No. 4, 33-6(Oct. 1962).

The Canberra homopolar generator has two similar 40-ton counter-rotating rotors serving the dual purpose of energy store and armature windings. Each rotor consists of two, insulated, flat, mild-steel discs 139" in diameter and 10" thick, cemented together with a separation of 1/8" and generating 200 volts each by 900 rpm in a field of 16,000 gauss. The bond between discs is required to withstand a 200-volt difference in potential and very large mechanical forces caused by temperature differences and short-circuit currents. Other requirements of the bond are set forth. The choice and application of an adhesive epoxy resin are described. (R.J.S.)

8540 THE UTILIZATION OF NEW ELECTRON TECHNIQUES IN THE SAFETY CIRCUIT OF NUCLEAR REACTORS. J. Furet. Bull. Inform. Sci. Tech. (Paris), No. 61, 24-36(May 1962). (In French)

The possibilities for the utilization of solid state devices in different elements of the safety circuit are examined, emphasizing the operational reliability and speed of response. The utilization of solid state devices in amplifiers and in disconnect or threshold systems is discussed, and examples are given. The replacement of electromechanical relays by solid state relays is considered. (J.S.R.)

8541 He^3 VAPOR PRESSURES: A STANDARD FOR IMPROVED THERMOMETRY BELOW 1°K. R. H. Sherman, T. R. Roberts, and S. G. Sydoriak (Los Alamos Scientific Lab., N. Mex.). Bull. Inst. Intern. Froid, Annexe 5, 125-33 (1961). (TID-13875; LADC-4888). (In English)

The advantages of He^3 over He^4 as a precise secondary standard for thermometry or paramagnetic salt calibrations at temperatures below 1°K are outlined. Two serious sources of error in He^4 thermometry due to the refluxing superfluid film are pointed out: the pressure drop and the Kapitza resistance (temperature drop). The thermodynamic inconsistency of the Argonne P_3 vs P_4 data is discussed in detail as an example of such errors. The measurements were repeated; the calculation of the pressure drop and elimination of the Kapitza resistance resulted in improved data. The current status of He^3 and He^4 thermometry is described briefly. (D.L.C.)

8542 HOW RADIO CAN PLOT HIGH-ALTITUDE NUCLEAR BLASTS. Electronics, 36: No. 2, 28-9(Jan. 11, 1963).

Recordings made during the high-altitude nuclear explosions over Johnston Island from July to Nov. 1962, shed new light on the electromagnetic waves associated with nuclear blasts. Hydrodynamic wave theory is used to explain the main part of the signal from a scope. The results recorded for five blasts are described briefly. The scopes were triggered about 30 μsec before the arrival of the main spike of the electromagnetic pulse. (D.L.C.)

8543 LEVEL INDICATORS AND LEVEL MEASURING INSTRUMENTS OPERATING WITH RADIOISOTOPES. János Kakas. Energia Atomtech., 15: 228-33(May 1962).

The theory of industrial radiological indicating, measuring, and control instruments is discussed. All industrial radiological level indicators and measuring instruments work on the principle of a rate meter. The average intensity of radiation is measured. Since the number of ionizing quanta detected in unit of time fluctuates, statistics have to be considered in constructing the measuring instruments. The discussion is divided into 2 main parts: the theory of rate meters and the resulting considerations and application of the instruments; and measurements and theoretical considerations. Finally, measurements are described for determining how far the potential distribution corresponding to the statistical fluctuations has to be considered in the design and construction of the instruments. (OID)

8544 A TRANSISTOR PREAMPLIFIER FOR SEMICONDUCTOR DETECTORS. A. Sona and V. Svelto (CISE, Milan). Energia Nucl. (Milan), 9: 694-8(Dec. 1962). (In English)

The best signal-to-noise ratio is described which is possible to achieve in measuring the charge released by a particle in a semiconductor detector with a transistorized preamplifier. From these calculations, some rules are derived to select the transistors for the preamplifier. A comparison between transistor and tube preamplifiers, connected to a semiconductor detector, shows that the system with tubes preamplifier is, as far as signal-to-noise ratio is concerned, better by a factor that can be only 2 to 3, with respect to the analogous case with transistor. A charge-sensitive transistorized preamplifier is described. (auth)

8545 GAMMA SONDE FINDS INTERFACE IN PROPANE STORAGE RESERVOIR. Guy Courtois (Commissariat a l'Energie Atomique, Saclay, France), Michel Gasnier, Claude Lallemant, and Alfred Servasier. Nucleonics, 21: No. 1, 76; 78(Jan. 1963).

Theory and laboratory study that led to a gamma sonde for determining the propane/brine interface in a propane storage system hollowed out of salt is given. Laboratory and field tests indicate the sonde performs very well. (D.C.W.)

8546 BACKSCATTERING THICKNESS GAGE TYPE OMG-2. Piotr Urbanski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika, 7: 531-4(1962). (In Polish)

8547 RADIOACTIVE SNOW GAGE. Kazuhiko Itagaki and Shoichi Koinuma (Sapporo Meteorological Observatory). Radioisotopes (Tokyo), 11: 350-4(Nov. 1962). (In Japanese)

Five seasons' experiences with a newly developed radio snow gage were described. The effect of temperature dependency of G-M counter was reduced by setting the G-M counter under the snow cover. The mass adsorption coefficient was 0.063 cm^2/g by this arrangement. The results show good agreement with the results of snow survey of the whole basin. (auth)

8548 ELECTRODELESS PLASMA CONDUCTIVITY PROBE APPARATUS. Robert A. Olson and Edmund C. Lary (United Aircraft Corp., East Hartford, Conn.). Rev. Sci. Instr., 33: 1350-3(Dec. 1962).

A means for measuring the electrical conductivity of a fluid without the use of electrodes was developed. A probe, consisting of a cylindrical single-layer solenoid enclosed within an insulating tube, is used in conjunction with an r-f oscillator-detector to measure the ohmic dissipation of a small amount of r-f power in the fluid. The probe samples the conductivity of the fluid in its immediate vicinity and may therefore be used to resolve conductivity profiles in an operating MHD device, for example. Since the surface of the probe is an insulator, it is possible that the influence of Hall effects and electrostatic sheaths may be effectively eliminated under certain conditions. Electrolytic solutions were used in calibration of the instrument. Instrumentation was developed for the application of the measuring technique to plasmas. Probes were operated successfully in the positive column of a hydrogen glow discharge and in a 4500°F rocket nozzle flow. (auth)

8549 PROBE FOR THE MEASUREMENT OF ALBEDO ELECTRON FLUX IN A HIGH-ENERGY ION BEAM. R. A. Hubach (Hughes Research Labs., Malibu, Calif.). Rev. Sci. Instr., 33: 1353-4(Dec. 1962).

A probe was developed to measure the flux of electrons traveling in a direction opposite to that of the ions in a high-energy ion beam. The probe is of the Langmuir type and will ideally obey the Mott-Smith, Langmuir theory for positive probe potentials. With this probe, the albedo electron flux has been measured in a beam of 1- to 2-kv cesium ions. (auth)

8550 DYNAMIC MAGNETIC MEASUREMENTS BY USE OF DAMPED OSCILLATORY FIELDS. Tait Elder and William Barte (Minnesota Mining & Mfg. Co., St. Paul). Rev. Sci. Instr., 33: 1360-6(Dec. 1962).

Full magnetic hysteresis loops, obtained by underdamped discharge of a capacitor through a solenoid, were used to study loop distortion produced by eddy currents, protracted or delayed flux changes, and instrumental errors. Pulsed

field loops obtained for γFe_2O_3 powder with 14,000-Oe maximum field closely overlapped loops obtained statically with one-tenth this field amplitude. In contrast, an apparent coercive force of 110 Oe was obtained with the pulsed field method for a sample of 0.158-cm-dia. iron wire having a static coercive force of 3.6 Oe. Almost two-thirds of the observed coercive force was attributable to eddy currents. Instrumental errors were less than 10 Oe and the residual coercive force was identified with the protracted flux change which has sometimes been attributed to magnetic viscosity in iron. Instrumental difficulties involved delay, distortion, or imperfect integration of high frequency components in detector coil signals, cumulative integration errors associated with low frequency components from nearly saturated specimens, and pickup. The detection system described is also suitable for quasistatic (slowly traced hysteresis loop) measurements. (auth)

8551 CIRCUIT FOR THE RAPID DETERMINATION OF LANGMUIR PROBE DATA. F. W. Crawford and R. S. Harp (Stanford Univ., Calif.). Rev. Sci. Instr., 33: 1387-91 (Dec. 1962).

The frequent use of Langmuir probes in the determination of electron temperatures and number densities in plasmas makes it desirable to have rapid methods of data reduction. A simple and accurate instrument is described for carrying this out without the necessity of using logarithmic amplifiers or oscilloscope displays. Apart from its advantages in ease of construction, its calibration is particularly simple and drift-free. In operation, the device samples the probe characteristic at two values of current, and yields a numerical value for the electron temperature on a meter. Linearity of the characteristic is examined by varying the sampling currents. Provisions are made for ion current to be compensated and measured, and for the electron saturation current to be estimated. (auth)

8552 HIGH-VOLTAGE PULSE MEASUREMENT WITH A PRECISION CAPACITIVE VOLTAGE DIVIDER. M. M. Brady and K. G. Dedrick (Stanford Univ., Calif.). Rev. Sci. Instr., 33: 1421-8(Dec. 1962).

The capacitive voltage divider can be designed to have an accurately known division ratio over a wide range of operating frequencies. A coaxial, guard-ring type geometry is described, and an analysis of possible errors due to geometrical anomalies and temperature variations is given. Due to the particular method of construction used, the division ratio of the divider itself is essentially independent of the dielectric constant of the dielectric oil used. Bridge circuits and their pertinent equations for calibrating the divider are presented. An experimental divider designed to operate on pulsed voltages up to 350 kv is described, having an overall division ratio of 1042.3 ± 6.0 with an expected temperature dependence of 0.01%/°C. (auth)

8553 HIGH TEMPERATURE THERMOBALANCE. P. F. Woerner and G. F. Wakefield (Texas Instruments Inc., Dallas). Rev. Sci. Instr., 33: 1456-7(Dec. 1962).

A thermobalance was designed and constructed that operated up to 3000°K in vacuum or inert atmosphere. The temperature was limited by the power supply. Its utility was first demonstrated by measuring the vapor pressure of niobium. A unique heater uses standard tungsten welding rods with a tantalum expansion joint. This design allows efficient transfer of metal vapor to the cooler shields. (auth)

8554 PROBLEMS IN ESTABLISHMENT OF A He^3 SCALE OF TEMPERATURE. T. R. Roberts, S. G. Sydoriak, and R. H. Sherman (Los Alamos Scientific Lab., N. Mex.). p.75-87 of "Temperature—Its Measurement and Control in Science and Industry. Vol. 3, Pt. 1. Basic Concepts, Standards, and Methods. 4th Symposium, March 27-31, 1961, Columbus, Ohio." New York, Reinhold Publishing Corp., 1962. (TID-12910; LADC-4589)

The difficulties involved in the use of liquid He^4 for thermometry at temperatures below 2.2°K are described briefly, and the advantages of He^3 over He^4 are outlined. The present status of the proposed new He^3 temperature scale is discussed. Methods for deriving the He^3 scale are described, and it is concluded that the γ scale is the best scale at the present time. However, probable thermodynamic inconsistencies were found in the scale input data, and further He^3 vs He^4 vapor pressure measurements are needed. Keller's He^3 isotherms were reanalyzed using the least-squares analysis method. (D.L.C.)

8555 THE PREDICTION OF ROCKET EXHAUST INTERFERENCE WITH RADIO SIGNALS. W. W. Balwanz and J. P. Weston (U. S. Naval Research Lab., Washington, D. C.). ARS Preprint 2591-62. New York, American Rocket Society, 1962. Prepublication Copy. 38p. $1.00.

A large number of parameters influence the propagation of command, guidance, and telemetry signals between a rocket and a ground station during powered flight. These are grouped into four major classifications, for convenience in discussion: the exhaust plasma, the interaction between the plasma and electromagnetic waves, the antenna-radiation pattern as influenced by the plasma, and the application to operational systems. Models for various phases of flight provide a method for predicting system performance. The combined experiences obtained from a variety of studies, i.e., from flight data, from sea-level measurements on small-scale and operational motor exhausts, from measurements at simulated altitude and under simulated flight conditions on the exhaust of scale-model motors, from measurements on laboratory flames, from theory, etc., provide the data required for the models. (auth)

8556 MULTI-POINT LEAK DETECTION SYSTEM FOR SPACE VEHICLE APPLICATIONS. Paul Erskine Brown and Myron L. Feistman (Radio Corp. of America, Camden, N. J.). Preprint No. ARS 2640-62. New York, American Rocket Society, 1962. Prepublication Copy. 9p.

A technique is described which enables continuous leak detection at many locations throughout a space vehicle with the leakage data made available in a format permitting its transmission via a telemetry link from the vehicle. The principle upon which the leak detection technique is based involves the addition of a radioactive gas, tritium, to the source material and subsequent detection of the leaking tritium with a solid state detector and associated electronics. Primary consideration was given to the detection of hydrogen from propulsion systems utilizing LOX-LH_2 engines. However, the technique may be extended to a variety of closed systems in which pressurized gases and cryogenic liquids are maintained. (auth)

8557 GAUGE FOR MEASURING THE DISPLACEMENT OF A BODY. Pierre Rouge (to Commissariat à l'Energie Atomique). British Patent 910,941. Nov. 21, 1962. Priority date Feb. 27, 1958, France.

A gage is designed for measuring the displacement of an inaccessible body, especially a pile of moderator material. The gage comprises a resilient member, a datum member movable in opposition thereto, and means for giving remote indication of the force exerted by the datum member on the resilient member when the resilient member is located against the body. The resilient member pref-

erably is a spring, the datum member a fluid-tight bellows, and the remote indication means a fluid pressure indicator. Equations are given for finding the displacement from the pressure readings. (D.L.C.)

8558 METHOD OF POSITIONING OBJECTS. Victor Boris Hessen (to Pye Ltd.). British Patent 911,604. Nov. 28, 1962. Filed Feb. 2, 1959.

A method is provided for accurately positioning an object when the object is in an inaccessible position, either physically or by reason of radiation hazards. Television camera tubes provided with reference and index means are employed. (R.J.S.)

8559 IMPROVEMENTS IN OR RELATING TO APPARATUS FOR MEASURING THE COEFFICIENT OF THERMAL CONDUCTIVITY OF SOLID MATERIALS. Paul Cogez, Claude Gewiss, and Jacques Humbert (to Commissariat à l'Energie Atomique). British Patent 911,849. Nov. 28, 1962. Priority date Apr. 15, 1959, France.

An apparatus is designed for measuring the thermal conductivity of refractory material samples by the steady heat flow method. In the apparatus, the screen surrounding the sample and witnesses is divided into three adjustable parts, and means is provided for canceling out the expansions due to temperature rises. (D.L.C.)

8560 IMPROVEMENTS IN OR RELATING TO SERVO-SYSTEMS. (to Commissariat à l'Energie Atomique). British Patent 912,617. Dec. 12, 1962. Priority date Mar. 10, 1958, France.

A servo-system of the electrically operated repositioning type is designed which is particularly applicable to the construction of an electromagnetically compensated precision balance with increased sensitivity. The servo-system comprises a movable member displaced from equilibrium by a variation in the magnitude being measured, and an electric signal produced by the displacement which returns the member to equilibrium and gives an output as a measure of the variation. A balance using the servo-system has a weighing capacity of up to 100 g and a sensitivity on the order of 3×10^{-9} g. (D.L.C.)

8561 IMPROVEMENTS IN OR RELATING TO INDICATOR DEVICES. Claude Argant and Andre Hupfer (to Commissariat a l'Energie Atomique). British Patent 914,304. Jan. 2, 1963. Priority date Jan. 22, 1960, France.

An indicator device is described for pressure pick-ups, comprising a stabilized power supply, an impedance-matching device, and an indicator unit equipped with an adjustable safety device activated when a predetermined maximum indication is reached. (R.J.S.)

8562 IMPROVED DEVICE FOR THE MEASUREMENT OF MAGNETIC FIELD BY MAGNETIC RESONANCE. (to Commissariat a l'Energie Atomique). British Patent 914,751. Jan. 2, 1963. Priority date May 17, 1958, France.

An apparatus is described for the very precise measurement of weak magnetic fields. Determination is made of the Larmor precession frequency or nuclear resonance frequency of atomic nuclei in interaction with a paramagnetic substance. This interaction produces a substantial increase in the amplitude of the nuclear magnetic resonance. (R.J.S.)

8563 APPARATUS FOR THE MEASUREMENT OF TEMPERATURES BY THERMOCOUPLE CONTACTS. (to Electricite de France-Service National). British Patent 914,833. Jan. 9, 1963. Priority date Dec. 17, 1959, France.

An apparatus was designed to measure temperatures by means of thermocouples within chambers accessible only through passages. The conductors are not continuous between the welded junction and the measuring instrument. (R.J.S.)

8564 IMPROVEMENTS IN OR RELATING TO TELEVISION CAMERAS. John Ernest Hiram Brace (to Marconi's Wireless Telegraph Co. Ltd.). British Patent 915,166. Jan. 9, 1963. Filed June 27, 1960.

The camera tube of a television camera is protected against interfering thermal neutron bombardment by a screening and protecting system. (R.J.S.)

8565 METHOD AND APPARATUS FOR CONNECTING A GETTER-ION PUMP TO AN ANALYTICAL MASS SPECTROMETER. Ernest W. Boyer, Harrell T. Ford, and Ernest E. McKelvey (to Continental Oil Co.). U. S. Patent 3,050,622. Aug. 21, 1962.

An apparatus for retaining a vacuum on a mass spectrometer tube is comprised of an ion pump, a pipe connection between the ion pump and the spectrometer tube, and an electrically conductive obstruction in the pipe grounded to the spectrometer tube. (R.J.S.)

8566 NUCLEAR ELECTROMAGNETIC RESONATOR. Wesley C. Miller. U. S. Patent 3,050,627. Aug. 21, 1962.

A nuclear electromagnetic resonator has been developed to detect the electromagnetic energy of the atom in wave frequency form. (R.J.S.)

8567 FLOW GATING. W. J. Poppelbaum (to U. S. Atomic Energy Commission). U. S. Patent 3,067,339. Dec. 4, 1962.

This invention is a fast gating system for electronic flip-flop circuits. Diodes connect the output of one circuit to the input of another, and the voltage supply for the receiving flip-flop has two alternate levels. When the supply is at its upper level, no current can flow through the diodes, but when the supply is at its lower level, current can flow to set the receiving flip-flop to the same state as that of the circuit to which it is connected. (AEC)

8568 SHORT PULSE STRETCHER. David R. Branum and William F. Cummins (to U. S. Atomic Energy Commission). U. S. Patent 3,067,344. Dec. 4, 1962.

A short pulse stretching circuit capable of stretching a short pulse to enable it to be displayed on a relatively slow sweeping oscilloscope is described. Moreover, the duration of the pulse is increased by charging a capacitor through a diode and thereafter discharging the capacitor at such time as is desired. In the circuit the trigger pulse alone passes through a delay line, whereas the main signal passes through the diode only, and results in over-all circuit losses which are proportional to the low losses of the diode only. (AEC)

8569 CIRCUITS FOR SAMPLING OSCILLOSCOPES. George Brian Barrie Chaplin, Alwyn Roberts Owens, and Charles James Nowell Candy (to United Kingdom Atomic Energy Authority). U. S. Patent 3,069,559. Dec. 18, 1962. Priority date Dec. 3, 1957, Great Britain.

A time-base circuit is described that includes a transistor having an emitter electrode, a base electrode, and a collector electrode. The transistor is connected to operate in the avalanche mode. (R.J.S.)

8570 METHOD OF MAKING TUNGSTEN FILAMENTS. Jack W. Frazer (to U. S. Atomic Energy Commission). U. S. Patent 3,069,584. Dec. 18, 1962.

A method of making tungsten filaments is described in which the tungsten is completely free of isotope impurities in the range of masses 234 to 245 for use in mass spec-

trometers. The filament comprises a tantalum core generally less than 1 mil in diameter having a coating of potassium-free tantalum-diffused tungsten molecularly bonded thereto. In the preferred process of manufacture a short, thin tantalum filament is first mounted between terminal posts mounted in insulated relation through a backing plate. The tungsten is most conveniently vapor plated onto the tantalum by a tungsten carbonyl vapor decomposition method having a critical step because of the tendency of the tantalum to volatilize at the temperature of operation of the filament. The preferred recipe comprises volatilizing tantalum by resistance heating until the current drops by about 40%, cutting the voltage back to build up the tungsten, and then gradually building the temperature back up to balance the rate of tungsten deposition with the rate of tantalum volatilization. (AEC)

8571 PULSE RATE DIVIDER. Henry C. McDonald, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 3,069,628. Dec. 18, 1962.

A compact pulse-rate divider circuit affording low impedance output and high input pulse repetition rates is described. The circuit features a single secondary emission tube having a capacitor interposed between its dynode and its control grid. An output pulse is produced at the anode of the tube each time an incoming pulse at the control grid drives the tube above cutoff and the duration of each output pulse corresponds to the charging time of the capacitor. Pulses incoming during the time the grid bias established by the discharging capacitor is sufficiently negative that the pulses are unable to drive the tube above cutoff do not produce output pulses at the anode; these pulses are lost and a dividing action is thus produced by the circuit. The time constant of the discharge path may be varied to vary in turn the division ratio of the circuit; the time constant of the charging circuit may be varied to vary the width of the output pulses. (AEC)

8572 METHOD AND MEANS FOR RECOGNIZING COMPLEX PATTERNS. Paul V. C. Hough (to U. S. Atomic Energy Commission). U. S. Patent 3,069,654. Dec. 18, 1962.

This patent relates to a method and means for recognizing a complex pattern in a picture. The picture is divided into framelets, each framelet being sized so that any segment of the complex pattern therewithin is essentially a straight line. Each framelet is scanned to produce an electrical pulse for each point scanned on the segment therewithin. Each of the electrical pulses of each segment is then transformed into a separate straight line to form a plane transform in a pictorial display. Each line in the plane transform of a segment is positioned laterally so that a point on the line midway between the top and the bottom of the pictorial display occurs at a distance from the left edge of the pictorial display equal to the distance of the generating point in the segment from the left edge of the framelet. Each line in the plane transform of a segment is inclined in the pictorial display at an angle to the vertical whose tangent is proportional to the vertical displacement of the generating point in the segment from the center of the framelet. The coordinate position of the point of intersection of the lines in the pictorial display for each segment is determined and recorded. The sum total of said recorded coordinate positions being representative of the complex pattern. (AEC)

8573 GEOPHYSICAL PROSPECTING METHODS AND APPARATUS. Arthur H. Youmans (to Well Surveys, Inc.). U. S. Patent 3,071,687. Jan. 1, 1963. Filed Apr. 10, 1959.

A radiation source-detector apparatus is designed for activation well logging. The apparatus is designed with increased horizontal cross sections at the levels of the radiation source and detector so that the well bore fluid is caused to flow by these levels at an increased rate and at a greater radial distance from the source; thus, the activation of the well bore fluid is reduced substantially. (D.L.C.)

8574 NUCLEAR MEASURING SYSTEM. Serge A. Scherbatskoy. U. S. Patent 3,071,689. Jan. 1, 1963. Filed Aug. 11, 1959.

A radiation source-detector apparatus is designed for well logging, measuring the thickness of a plate from one side, and indicating the liquid level in oil tanks. The apparatus comprises a radiation source placed adjacent to the detector, a proportional detector for producing impulses proportional to the radiation energy, and a threshold network for transmitting only these impulses within an energy range corresponding to scattered or induced radiation. Thus, the need for a shield between the source and the detector is eliminated. (D.L.C.)

8575 GAUGE. Guenter Reich (to E. Leybold's Nachfolger). U. S. Patent 3,071,704. Jan. 1, 1963. Priority date June 3, 1960, Germany.

An ionization gage of the Bayard-Alpert type is designed for measuring very high vacuum. The gage differs from other gages in that the shielding envelope for the ion collector filament is made out of a metal or glass with a metal coating, rather out of glass alone. Thus, variations in the pressure reading due to charge changes on the envelope can no longer occur. (D.L.C.)

8576 COAXIAL FILAMENT TRANSFORMERS FOR PULSE CIRCUITS. Dean O. Kippenhan (to U. S. Atomic Energy Commission). U. S. Patent 3,071,734. Jan. 1, 1963.

This patent relates to a filament power supply for high speed high voltage pulse tubes in which the filament supply is fully isolated from the output of the tube. Pulses are generated by discharging an electrically charged line through the tube. Filament current for the tube is obtained from a transformer, the secondary winding of which is a coaxial cable having both ends of the inner conductor connected to the filament terminals and both ends of the outer conductor grounded. The outer conductor has a break at its midpoint. With alternating current excitation applied to the primary winding of the transformer, the inner conductor of the cable provides current to the tube filament. Pulse currents, however, are equal and opposite in the inner and outer conductors of the cable and hence do not couple with the transformer. (AEC)

8577 PULSE AMPLIFIER FOR ALTERING THE SHAPE OF UNDERSHOOTS. E. Fairstein and R. A. Dandl (to U. S. Atomic Energy Commission). U. S. Patent 3,072,851. Jan. 8, 1963.

Short circuited delay lines are used to limit the effects of undershoots by incorporating them into the system as coupling networks at a number of places in a multistage amplifier. (AEC)

8578 X-RAY DIFFRACTION APPARATUS. Lloyd R. Rose (to General Electric Company). U. S. Patent 3,073,952. Jan. 15, 1963. Filed Sept. 11, 1956.

An x-ray-diffraction spectrometer is designed for the analysis of fluorescent x rays emitted by a specimen. The spectrometer has the diffraction crystal and detector mounted on a turntable which is provided with gears for moving the crystal and detector in order to scan the x-ray spectrum. (D.L.C.)

8579 APPARATUS FOR SIMULTANEOUS NEUTRON AND PHOTON LOGGING WITH A SINGLE DETECTOR.

Arthur H. Youmans (to Well Surveys, Inc.). U. S. Patent 3,073,958. Jan. 15, 1963. Filed Apr. 30, 1959.

A well-logging apparatus is designed which enables the simultaneous use of gamma-gamma logs with neutron-neutron or neutron-gamma logs, using only one detector. The detector is of the pulse type so that the detector signals are related to the energy of the radiation incident on the detector. A discriminator is used to resolve the radiations due to the neutrons and gammas from the source. (D.L.C.)

8580 ION SOURCE WITH SPACE CHARGE NEUTRALIZATION. J. W. Flowers, J. S. Luce, and W. L. Stirling (to U. S. Atomic Energy Commission). U. S. Patent 3,075,115. Jan. 22, 1963.

This patent relates to a space charge neutralized ion source in which a refluxing gas-fed arc discharge is provided between a cathode and a gas-fed anode to provide ions. An electron gun directs a controlled, monoenergetic electron beam through the discharge. A space charge neutralization is effected in the ion source and accelerating gap by oscillating low energy electrons, and a space charge neutralization of the source exit beam is effected by the monoenergetic electron beam beyond the source exit end. The neutralized beam may be accelerated to any desired energy at densities well above the limitation imposed by Langmuir-Child's law. (AEC)

8581 HYGROMETER. C. M. Stover (to U. S. Atomic Energy Commission). U. S. Patent 3,075,385. Jan. 29, 1963.

This patent relates to a hygrometer having a rapid and essentially straight line response to changes in relative humidity and a high degree of sensitivity to moisture in the low relative humidity range. In particular, the hygrometer comprises a metal plate coated with a hygrometric oxide coating, and electrical leads coupled to the metal plate and the oxide coating, respectively. When a change in relative humidity occurs, a change in the resistance and capacitance between the leads takes place owing to the hygrometric action of the oxide coating. Thus, with a voltage being applied to the leads, a change in capacitance and resistance between them causes a proportional change in the current between the leads. This may be read upon a suitable indicator for determining the relative humidity at any given instant. (AEC)

8582 A SMALL-ANGLE DRILL-HOLE WHIPSTOCK. Dale E. Nielsen, James L. Olsen, and Walter P. Bennett (to U. S. Atomic Energy Commission). U. S. Patent 3,075,583. Jan. 29, 1963.

A small angle whipstock is described for accurately correcting or deviating a drill hole by a very small angle. The whipstock is primarily utilized when drilling extremely accurate, line-of-slight test holes as required for diagnostic studies related to underground nuclear test shots. The invention is constructed of a length of cylindrical pipe or casing, with a whipstock seating spike extending from the lower end. A wedge-shaped segment is secured to the outer circumference of the upper end of the cylinder at a position diametrically opposite the circumferential position of the spike. Pin means are provided for affixing the whipstock to a directional drill bit and stem to alloy orienting and setting the whipstock properly in the drill hole. (AEC)

8583 MEASURING CIRCUIT. J. R. Mahoney (to U. S. Atomic Energy Commission). U. S. Patent 3,076,091. Jan. 29, 1963.

A measuring and balancing arrangement for mass spectrometers permits the ready determination of isotopic ratios and mole and weight percentages by employing a selection of amplifier input resistors to vary sensitivity in a bridge arrangement. (AEC)

Radiation Detection

Refer also to abstracts 7711, 7721, and 10019.

8584 (AD-286928) DESIGN AND CONSTRUCTION OF A FAST NEUTRON SPECTROMETER USING SOLID STATE DETECTORS (thesis). Phillip Darden Weinert (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio). May 1962. 154p. (GNE/Phys/62-17)

A fast neutron spectrometer is designed and constructed. The spectrometer uses He^3 gas at pressures up to 1500 psi as the reacting medium for fast neutrons and solid state detectors as the means of detecting the product particles of the reaction. An investigation is made into the best geometry and materials to use in order to obtain optimum use of the solid state detectors. A digital computer program is presented to calculate and plot the energy and angular distribution of the products of the reaction. To prepare targets for neutron production with a Van de Graaff generator, two means of obtaining a thin metallic coating on a target disc are investigated. These are ion sputtering and reduction of a metal from a new metallic compound, $Zr(TFA)_4$. The design and construction of the spectrometer are completed but no spectroscopic data taken. Use of the computer program provides data with good correlation to that found in the literature. Some experimental data are obtained concerning the ion sputtering process. (auth)

8585 (AE-91) THE ENERGY VARIATION OF THE SENSITIVITY OF A POLYETHYLENE MODERATED BF_3 PROPORTIONAL COUNTER. R. Fraeki, M. Leimdoerfer, and S. Malmskog (Aktiebolaget Atomenergi, Stockholm). Nov. 1962. 20p.

The sensitivity relations of a polyethylene-moderated boron trifluoride counter with variation of neutron energy were investigated experimentally and theoretically at 2.3 Mev, 550 kev, 210 kev, 110 kev, 340 ev, and 5 ev. Results show good agreement between theoretical and experimental sensitivities for the kev and Mev energies while discrepancies were noted in the ev region. (J.R.D.)

8586 (APGC-TDR-62-27) CALIBRATION OF INSTRUMENTS FOR RADIATION MEASUREMENTS FROM LOFTED VEHICLES. W. O. Banks (Air Proving Ground, Eglin AFB, Fla.). May 1962. 8p. (AD-277059)

The designs and developments accomplished by the Air Proving Ground Center in support of Project TRUMP are considered. Project TRUMP pertains to the design and development of methods for measuring radiation from lofted vehicles. Several methods of simulating the space environment, for purposes of ground calibration of instruments to be lofted, are proposed. A mathematical approach, similar to that used by early Smithsonian solar constant seekers, is presented. (auth)

8587 (AWRE-NR/P-4/62) THE AWRE FAST NEUTRON CHOPPER. E. E. Maslin and J. M. A. Reichelt (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Dec. 1962. 28p.

The design of the AWRE fast neutron chopper is described. Two rotors are incorporated in the chopper which produce neutron bursts with durations of 3 to 100 μsec at rotor speeds of 600 to 15,000 rpm. Flight paths of 10 and 25 m are in use. (J.R.D.)

8588 (BNL-6442) 6 kv CAPACITOR CHARGING SUPPLY. D. M. Miller (Brookhaven National Lab., Upton,

N. Y.). Mar. 15, 1962. Contract [AT-30-2-GEN-16]. 7p. (IHR-116)

The power supplies designed and constructed to power high intensity flash tubes used in bubble chamber experiments are briefly described and are accompanied by a schematic diagram of the layout. (D.C.W.)

8589 (CRRD-1105) A CUBICAL ARRAY OF CESIUM 137 γ-RAY SOURCES FOR CALIBRATING INSTRUMENTS. A. R. Jones (Atomic Energy of Canada Ltd., Chalk River, Ont.). Oct. 1962. 11p. (AECL-1628)

An arrangement of eight gamma-ray sources in a cubical array is described which enables the testing of radiation survey meters in relatively uniform fields. By changing the dimensions of the array, three radiation intensities extending from 86 mr/h to 8.5 r/h can be produced. Results of measurements made on the arrays are compared with calculated predictions of their performance. (auth)

8590 (NAA-SR-7077) THE DEVELOPMENT OF LINEAR POWER DETECTION AND RECORDING INSTRUMENT SYSTEMS FOR THE KINETIC EXPERIMENTS ON WATER BOILERS. E. L. Gardner (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Feb. 1, 1963. Contract AT(11-1)-Gen-8. 54p.

A brief history is presented of the evolution of the linear power recording instrument systems used in the Kinetic Experiments on Water Boilers Program. Reduction of the data taken by these systems showed a systematic dynamic change of calibration during a power transient. Tests were conducted on both the electronic and neutron sensing portions of these systems. It was determined that the ratio of neutron to gamma ray sensitivity changed during a transient. Since the usual chamber compensation methods will not work under such circumstances, a series of shields was constructed and tested to attenuate the gamma ray response of the ionization chambers. Gamma ray attenuators were developed which provided adequate neutron transmission for accurate measurement of power transients with periods as short as one millisecond. (auth)

8591 (NP-12340) DETECTORS SENSITIVE TO GAMMA RAY POLARIZATION. G. J. McCallum (New Zealand. Inst. of Nuclear Sciences, Lower Hutt) and J. Vervier (Mol, Belgium. Centre d'Etude de l'Energie Nucleaire). [1962]. 117p. (INS-R-16)

A chapter from the book entitled Scintillation Spectroscopy of Gamma Radiation is presented. Information is included concerning polarization-sensitive processes, design of Compton scattering polarimeters, calibration of polarimeters, and angular correlation theory. (J.R.D.)

8592 (NP-12422) THERMOLUMINESCENT DOSIMETER COMPUTER-INDICATOR SYSTEM. Phase II, Second Interim Engineering Report, October 15, 1961 to February 15, 1962. (Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). Feb. 21, 1962. Contract NObsr-85506. 45p.

During the preceding 4-month interval, extensive progress was made in the thermoluminescent dosimeter program. Research was directed in three main areas in order to complete the development program satisfactorily. These areas are concerned with synthesis of large (0.5 lb) batches of the CaF_2:3% Mn phosphor, development of the electronics of the computer-indicator to the degree of reliability and automation desired, and development of the mechanical portions of the computer-indicator and dosimeter. (auth)

8593 (ORNL-3311) COMPUTATION OF LOSSES DUE TO MULTIPLE SCATTERING OF CHARGED PARTICLES IN THIN FOILS. J. B. Ball (Oak Ridge National Lab., Tenn.). [May 16, 1962]. Contract W-7405-eng-26. 37p.

The losses of charged particles from a detector aperture, due to multiple scattering of the particles in thin layers of material preceding the detector, are calculated with the aid of a high-speed digital computer. The root-mean-square multiple-scattering angle is computed after the method of Moliere, and graphs are presented for protons and alpha particles scattering in nitrogen, aluminum, argon, copper, silver, and gold, and for deuterons and tritons scattering in aluminum and copper. The range of particle energy covered is from 5 to 100 Mev. A second program is used to construct a map from which losses, as a function of the root-mean-square multiple-scattering angle and the scattering configuration, may be directly read. The FORTRAN listings for both programs are given. (auth)

8594 (PAN-352/XIII) ABSOLUTE MEASUREMENT OF γ-EMITTERS ACTIVITY BY MEANS OF THE AIR-WALL CURRENT IONIZATION CHAMBER. Jadwiga Jabłońska and Konrad Jabłoński (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). July 1962. 17p.

The graphite cavity ionization chamber is used for the measurement of the γ-emitters activity. The required correction factors are calculated or experimentally determined. Information on the construction of the ionization chamber and of the measurement bench is also given. (auth)

8595 (RT/EL(62)11) UN CONTATORE ELETTRONICO PER DOSI DI RADIAZIONE. (Electronic Counter for Measuring Radiation Doses). R. Cervellati, R. Marconero, and C. Pedicino (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori di Elettronica, Rome) Sept. 1962. 27p.

An electronic apparatus is described for the measurement of the electric charge carried by currents in the range 10^{-6} to 10^{-12} amp, particularly useful for measurements of exposure dose to ionizing radiation. (auth)

8596 (TID-15541) VARIANCE IN SCINTILLATOR LIGHT COLLECTION. George A. Sinnott and William W. Managan (Argonne National Lab., Ill.). Feb. 1962. Contract W-31-109-eng-38. 8p. (UAC-6097)

A Monte-Carlo program for the "GEORGE" Computer at Argonne National Laboratory was used to compute the average path length and number of diffuse reflections of a light ray originating at a given point in a cylinder before it is absorbed in a "black" concentric circle in the bottom of the cylinder. The variance of these numbers was estimated and indicated light trapping effects. Total internal reflection at the exit ("black") interface was included. The average number of reflections increased rapidly as the crystal length exceeded one diameter. (auth)

8597 (TID-15552) SEMICONDUCTOR NUCLEAR DETECTORS. H. M. Mann, J. W. Haslett, and F. J. Janarek (Argonne National Lab., Ill.). Jan. 1962. Contract [W-31-109-eng-38]. 22p. (UAC-6031)

Results on the preparation and use of lithium-ion-drifted junctions in silicon for nuclear detection are summarized. Lithium was diffused into silicon in vacuum at 350 to 400°C. After drift at 150°C in a silicone oil bath, a sensitive thickness of 2 to 4 mm was obtained. The response to protons at energies from 4.5 to 10 Mev was linear to within ±0.3%. The resolution width for protons at the higher energy, and for deuterons at 20 Mev, was limited by beam energy spread in the Argonne 60-in. cyclotron. The resolution width for electrons was 26 kev (at 500 kev and 1 Mev) and that for gamma rays was 9 kev (at 661 kev). (auth)

8598 (TID-17777) A NEW DEVICE FOR DETECTING LOW LEVELS OF IONIZING RADIATION. Adli M. Bishay

(Argonne National Lab., Ill.). Oct. 1962. Contract [W-31-109-eng-38]. 8p. (UAC-7007)

A new device which can be used for detecting ionizing radiation is described. The major part of this device consists of a potassium alumino borate glass containing a high concentration of cerium and melted under strongly reducing conditions. A strong absorption band is induced by ionizing radiation at about 700 mμ borate glasses containing a high concentration of cerium mostly in the cerous condition. This band, associated with the formation of (Ce^{3+} + e) centers, is very sensitive to low exposures of ionizing radiation. The above property was made use of in designing the radiation detection device. (auth)

8599 (UCRL-6825) CALCULATION OF THE OPTIMUM DIMENSIONS OF COLLIMATORS FOR NEUTRON DIFFRACTION. Ian R. Jones (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 14, 1962. Contract W-7405-eng-48. 8p.

Most parameters affecting the neutron intensity transmitted by a primary Soller collimator are predetermined. Optimization of the number of collimating channels remains, however, and a method for calculating this number and the corresponding neutron intensity is given. Equations used are explained and permit comparison of intensities for sets of alternative parameters. (D.C.W.)

8600 (UCRL-6878) HIGH-PRESSURE HELIUM–XENON GAS SCINTILLATOR. Bryan D. Walker and Raymond Gold (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 12, 1962. Contract W-7405-eng-48. 15p.

A high-pressure He–Xe gas scintillator was developed for use in analyzing neutron spin polarization. Details of the counter design and operation are presented. The characteristics of this detector for various He–Xe gaseous mixtures were investigated at pressures up to 1000 psi. With p,p'-diphenylstilbene as a wave-length shifter, the optimum resolution for 5.48-Mev alpha particles (Am^{241}) is approximately 20%. This resolution is roughly pressure independent for partial pressures of very pure He above 100 psi. The effect of the N_2 impurity content in the He is also indicated. The long-term stability of the counter is excellent. (auth)

8601 (WCAP-2117) MINIATURE NEUTRON DETECTOR DEVELOPMENT. Quarterly Progress Report, July 1, 1962–September 30, 1962. J. Weisman, ed. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Work performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2827. 13p. (EURAEC-495)

The techniques for device production have continued to be improved. Substantially better yields are now being obtained and eight additional diodes which count at room temperature were produced. Room temperature characteristics of these diodes were measured. Three previously produced diodes were evaluated at elevated temperatures. Two of the diodes showed good counting characteristics over the range of 25 to 400°C. After preliminary examination of the new diodes at elevated temperatures, they will be used in radiation damage studies. (auth)

8602 (CEA-tr-A-1063) DISPOSITIF DE MESURE SENSIBLE POUR CONTROLE DE LINGE CONTAMINÉ PAR LA RADIOACTIVITÉ. (Sensitive Measurement Apparatus for Inspection of Contaminated Cloth for Radioactivity). H. Kiefer, R. Maushart, and G. Staeblein. Translated into French from Kerntechnik, 3: 316-17(1961). 8p.

A sensitive and reasonable apparatus designed to monitor the α or β activity of contaminated clothes and linens is described. The sensitivity of the apparatus permits a separation of clothes that contain radioactivity that would cause an above-normal radioactivity in the wash water. (tr-auth)

8603 (CEA-tr-A-1208) LES VERRES POUR DOSIMETRIE. (Glasses for Dosimetry). (Kernforschungszentrum. Institut für Experimentelle Kernphysik, Karlsruhe, Germany). Translated into French from German report. [1962]. 32p.

The measurement of gamma dose during full power operation of the FR-2 Reactor using glass dosimeters is described. The causes for the radioinduced variation of the optical properties of glass are reviewed, and then the properties and composition of the glass used for gamma dosimetry are given. The procedure used for measuring the variation of the optical properties is described. The relations between optical variation and gamma energy, between optical variation and dose intensity, and between optical density and dose are given. The effect of temperature during irradiation on these relations is discussed. The fading of the property variation for irradiation is considered. Extinction at high temperatures and sensitivity to neutrons are also discussed. The dimensions and calibration of the glass are reviewed. (J.S.R.)

8604 (DEG-Inf-Ser-285) THE FUNCTIONING OF SPARK COUNTERS. D. Blanc. Translated by G. C. Curtis (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from J. Phys. Radium, 15: 483-9(1954). 13p.

The fundamental characteristics of wire plate, parallel plate, plane, and cylindrical counters are reviewed. Attention is directed to delay time, paralysis time, shape of the plateau, and variables on which the plateau depends. Aspects of counter construction are also discussed. (J.R.D.)

8605 THE EFFICIENCY OF A COUNTING EQUIPMENT. V. Popovic and B. M. Saler (Inst. for Medical Studies and Occupational Medicine, Zagreb). Arhiv Hig. Rada Toksikol., 13: 101-6(1962).

The theoretical bases and practical procedure in measuring radioactive counter accuracy by means of a $K^{40}ClO_3$ standard are described. A homogenous specimen of the labeled compound was prepared and used to determine the accuracy of a Geiger-Mueller counter used to measure total beta radioactivity in water and air. (P.C.H.)

8606 USE OF "K" TYPE NUCLEAR EMULSION FOR THE DETERMINATION OF FAST NEUTRONS IN PERSONNEL MONITORING. L. S. Zolin, V. N. Lebedev, and M. I. Salatskaya. At. Energ. (USSR), 13: 467-71(Nov. 1962). (In Russian)

For accurate measurement of the absorbed neutron dose the energy dependence of the detector must coincide with that of the tissue; interference by the accompanying γ radiation must be kept to a minimum. Thin layers of nuclear emulsions satisfy this requirement to the greatest extent. Good detectors may be prepared by alternating hydrogenous materials and absorber layers, ensuring the proportionality of the recoil protons with dose absorbed by the tissue. Such a system was used for the fabrication of personnel monitoring devices. A 20-micron thick nuclear emulsion was employed; it was found to be suitable for recording the tracks of protons in the range from 0.3 to 150 Mev. The sensitivity of the unit was 4×10^{-4} tracks/neutron from a Po–Be source; its accuracy was 20% of the maximum permissible monthly dose. Within the neutron energy range from 0.5 to 15 Mev, the energy dependence of the tracks in the case of isotropic radiation corresponded to

the dose curve of the bio-tissue within 15%. Hard γ rays of Co^{60} did not interfere with the interpretation of the readings below a 5 r dose. A technician can inspect 85 films during the 36-hour work week. (TTT)

8607 CERTAIN CHARACTERISTICS OF THE MEASUREMENTS OF THE ENERGY SPECTRA OF α-PARTICLES AND FISSION PRODUCTS BY SEMICONDUCTOR-TYPE DETECTORS. V. A. Blinov, S. A. Karamyan, O. A. Matveev, Yu. A. Nemilov, and Yu. A. Selitskiĭ. At. Energ. (USSR), 13: 476-8(Nov. 1962). (In Russian)

Semiconductors are useful for measuring the energy of short-lived particles such as α-particles and fission products when the use of Si with relatively low resistance is permissible. The fact that under certain conditions the pulse amplitude is reduced made it necessary to study the system more closely before determining the fission characteristics. Tests were carried out with surface-barrier type semiconductor detectors with a resistance of 150 ohm cm. The instrument was used for determining the low-energy tail of the energy spectrum of Am^{241} α particles by covering the detectors with a 0.05-mm thick Al layer, amounting to 2 mean free path lengths of the particles. Thermal neutrons were obtained by slowing down with paraffin neutrons from the $Be^9(d,n)B^{10}$ reaction. It was found that irradiation of the detectors with a flux of about 5×10^{11} n/cm^2 results in an increase of their resistance from 150 to 1000 ohm cm, causing only a distortion of 2 to 3% in the energy spectrum of the fission products. This increase is probably caused by a compensation of the effect of impurities by the nuclear reaction products. (TTT)

8608 DISCRIMINATION AND DETECTION OF RADIOACTIVITIES. R. Piesch (Siemens and Halske A. G., Karlsruhe, Ger.). Atomwirtschaft, 7: 602-6(Dec. 1962). (In German)

In radiation measuring techniques the limits of measurement of a counting system must frequently be determined. These depend upon numerous parameters. The conceptions of discrimination limits and of detection limits are explained in terms of error theory, and their dependence on the magnitudes of various factors is set out. The size of these factors is determined by the properties of the detector, of the ambient radiation field, of the radiation to be measured, and of the chosen method of working. Relations may be discovered by the application of extremal calculations that optimize either the detection limits or the total measuring time, the other quantity being regarded as fixed. The measuring limits are turned into units of activity and dose in order that they may be applied for radiation protection measurements. The detection limit is not a characteristic of a radiation detector or of a counting arrangement. It is therefore better in place of a detection limit to quote the various parameters in so far as they themselves relate to the detector. (auth)

8609 A PULSE SPECTROSCOPE WITH ELECTRONIC NEUTRAL WEDGE. H. Hoetzel (Siemens and Halske A. G., Karlsruhe, Ger.). Atomwirtschaft, 7: 607-11(Dec. 1962). (In German)

A pulse spectroscope with electronic grey wedge is described that enables pulse-height spectrograms to be displayed on a cathode-ray-tube screen. The pulse number and the measurement time can be preselected for photographic exposures. The apparatus is intended for qualitative and quantitative analysis of gamma or x radiations, which are detected by a detector working in the proportional region. The device is applicable to the serial investigation of evaporated liquid specimens or of filter extracts in air or water monitoring, to material analyses or, for example, to the identification of preparations by means of their decay times. Its working principle, construction, and electronics are explained, together with details of the evaluation of the screen image, of the photographic techniques, and of practical application. (auth)

8610 NEUTRON DETECTORS. J. Duchêne. Bull. Inform. Sci. Tech. (Paris), No. 61, 6-15(May 1962). (In French)

As an introduction to a description of actual neutron detectors, the operation of detectors at high temperature and in high gamma and neutron flux is discussed. The design, operation, and performance of two fission chambers for use at high temperature and a boron ionization chamber compensated electrically for gamma radiation are described. (J.S.R.)

8611 PROGRESS IN PERIODIC AND LOGARITHMIC AMPLIFIERS. J. Bourdel. Bull. Inform. Sci. Tech. (Paris), No. 61, 16-23(May 1962). (In French)

Logarithmic amplifiers associated with ionization chambers deliver a voltage proportional to the logarithm of the current output of the chamber. The design, operation, and performance of a direct current periodemetry (P 60) are discussed. (J.S.R.)

8612 STUDY AND REALIZATION OF THE REACTOR CONTROL MATERIAL: NEUTRON CONTROL; RADIOPROTECTION CONTROL. M. Cordelle, V. Delcroix, and R. Gariod (Centre d'Etudes Nucleaires, Grenoble, France). Bull. Inform. Sci. Tech. (Paris), No. 61, 37-45 (May 1962). (In French)

Studies that have led to the construction of measurement circuits for reactor control and radiation protection are briefly described. The apparatus described permits the measurement of neutron fluxes in a range from 15 to 8×10^9 n/cm^2/sec. Each apparatus has controllable thresholds which release signals, alarms, or scram rods. The engineering characteristics of some specific devices are given. (J.S.R.)

8613 A DEVICE FOR AUTOMATIC RECORDING OF CHARACTERISTICS OF A GAS-DISCHARGE-TYPE NUCLEAR RADIATION COUNTER. A. P. Dudkin. Byul. Izobret., No. 9, 42-3(1962).

A device for automatic recording of characteristics of a gas-discharge-type nuclear radiation counter, contains a pulse counter and input units. It is distinguished by the fact that, to automatically record the characteristics on paper, the galvanometer coil, deflected by a current arriving from a counter converted from a-c into d-c, is connected with a recording pen. (OTS)

8614 CZECHOSLOVAK NUCLEAR EMULSION USED FOR DETECTING FAST NEUTRONS. L. Tomášková (Nuclear Research Inst., Czechoslovak Academy of Science, Prague). Czech. J. Phys., 12: 875-6(1962). (In English)

The production of a photographic film having a high gelatine content (and hence a high H content) is reported. The film has a sensitivity to fast neutrons of 7×10^{-4} proton traces/incident fast neutron, and the interposition of a polythene foil between the fast neutrons and the film increases this sensitivity to 22.5×10^{-4} proton traces/incident fast neutron. These proton traces are caused by elastic p-n collisions. (T.F.H.)

8615 MEASUREMENT OF THE γ-DOSE BY MEANS OF FILM BADGES. Dániel Voedroes (Municipal Public Health and Communicable Diseases Station, Budapest). Energia Atomtech., 15: 513-17(Oct.-Nov. 1962). (In Hungarian)

Monitoring of individuals assigned to work locations

where they might be exposed to γ-radiation is carried out on the basis of the standards set by the ICRP in 1959. Routine measurements are based on the use of ionization chambers or of photographic film. The 2 methods are not competitive; rather, they supplement each other. Techniques based on the darkening of photographic emulsion played a great role in radiation measurement since the discovery of radioactivity more than 65 years ago because the densitometric method may be used conveniently on a large scale. Secondary factors must be taken into consideration in the measurements; they include variations in the fabrication, fogging caused by background radiation or storage at high temperatures. The emulsion records the photons as a function of their energy, resulting in differences between numerical values of the measurements and actual radiation effects in air. Variations of the sensitivity of the emulsion are not parallel with the changes of the attenuation coefficients; a factor of 30 must be used when comparing the 70-kev radiation, which causes maximum darkening, and the γ-radiation of Co^{60}. The tests made were restricted to the 0.3 to 1.5-Mev range using Co^{60}, Cs^{137}, Hg^{203}, and Ra sources and various films compared. It was found that the Hungarian-made emulsions may be used in the following ranges: 50 to 700 mr; 200 to 2000 mr; and 100 to 1500 mr. (TTT)

8616 ON THE RESPONSE OF THE IONIZATION CHAMBERS TO PULSED GAMMA RADIATION. M. L. Corazza, M. Ladu, M. Pelliccioni, and E. Rotondi (CNEN, Frascati, Italy). Energia Nucl. (Milan), 9: 690-3(Dec. 1962). (In Italian)

The response of the ionization chambers to pulsed γ radiation was studied, using frequencies of 1, 5, 10, and 20 p/s, and collection voltage from 5 to 700 v. It was found that, for the same collected voltage, the collected charge per pulse decreases with increasing frequency, but is almost independent of the latter for voltages greater than 200 v. Within the limits of the described experiment, the agreement with the Boag's theory is satisfactory for collection efficiencies greater than 0.9. (auth)

8617 EXPERIMENTS WITH DIFFERENT GAS MIXTURES IN THE LIGHT CHAMBER. F. T. Arecchi, G. Cavalleri, P. Principi, and G. Redaelli (CISE, Milan). Energia Nucl. (Milan), 9: 713-14(Dec. 1962). (In English)

Different gas mixtures were tested in the light chamber for maximum luminous output in order to obtain good photographs of particle tracks. The best mixture appears to be Ne–2% Ar–0.5% Xe. A double coincidence system was devised to reduce the rate of spurious triggerings. (D.L.C.)

8618 METAPHOSPHATE GLASS AS AN INTEGRATING DOSIMETER. J. S. Cheka (Oak Ridge National Lab., Tenn.). Health Phys., 8: 551-2(Oct. 1962).

A glass comprising a mixture of metaphosphates, one of which is $AgPO_3$, has the property of fluorescing under ultraviolet light after exposure to ionizing radiation. This property was used in the design of microdosimeters of γ radiation. The dosimeters consist of rods 6 mm long and 1 mm in diameter. The amount of fluorescence is approximately proportional to dose up to several thousand roentgens. The lower limit is fixed by the pre-dose fluorescence. An evaluation was made of the response of these dosimeters using a modified and improved micro-dosimeter reader. Data are presented on the time-dependence of low-dose response of fluorods of several different compositions exposed to 10 mr of radium γ-rays per working day for one year. (C.H.)

8619 PARTICLE DETECTORS. PART 2. F. M. Russell. Instr. Pract., 16: 1490-3(Dec. 1962).

Signal and noise levels in the human eye are discussed. In the detection of particles, four questions should be answered: the type of particles detected, number arriving at the detector per unit time, particle energy, and time of arrival at the detector. The principle of gas multiplication is discussed, and the general characteristics of detectors working in the three regions of gas multiplication are examined: ionization chambers, proportional detectors, and Geiger-Müller counters. (D.L.C.)

8620 PARAMETERS AFFECTING THE RESOLUTION OF A PROPORTIONAL COUNTER. A. Williams and R. I. Sara (National Physical Lab., Teddington, Middx., Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 229-38(May 1962). (In English)

Measurements of the dependence of the gas gain of a cylindrical proportional counter on the anode and cathode radii, anode voltage, and gas density are described. From these measurements, the effect on the resolution of variations in these parameters is calculated. A theoretical formula for the gas gain is derived, which is in agreement with the experimental results. (auth)

8621 DIRECTION-SENSITIVE DETECTORS FOR γ RADIATION AND THEIR USE IN MEDICINE. F. Timpl. Isotopen Tech., 2: 336-8(Nov. 1962). (In German)

The designs of directional wide-angle and narrow collimated-angle detectors are described. Diagrams are included. Medical uses of these detectors are discussed. (M.C.G.)

8622 NEUTRON PROBE WITH PULSE FISSION CHAMBER AND FERRITE TRANSFORMER. P. Kovanic and J. Rygl (Inst. of Nuclear Physics, Czechslovak Academy of Sciences, Prague). Jaderna Energia, 8: 427-8(1962). (In Czech)

The use of a neutron probe equipped with a pulsed fission chamber and ferrite transformer for measuring neutron flux in vertical reactor channels located in the vicinity of active reactor core is discussed. The probe was designed for fully automatic reactor control systems. (P.C.H.)

8623 A THERMOLUMINESCENT DOSIMETER. Z. Spurný (Inst. for Nuclear Research, Prague). Kernenergie, 5: 611-15(Aug. 1962). (In German)

The preparation of $CaSO_4$:Mn crystals, the construction and properties of a thermoluminescent dosimeter prepared using these crystals, the test apparatus, and the first results obtained with it are described. Gamma radiation doses between 0.01 and 10,000 r could be measured. The dosimeter has very small dimensions and is not sensitive to neutrons. It is also suitable as an accident dosimeter through its large fading since the radiation energy is not continuously accumulated in contrast to fading-free crystals. (tr-auth)

8624 PHOTOELECTRONS AND THEIR BACK DIFFUSION IN SELF-QUENCHING GEIGER-MÜLLER COUNTERS. Rafi Mohammed Chaudhri and M. Munawar Chaudhri (Government Coll., Lahore, West Pakistan). Nature, 196: 664-5(Nov. 17, 1962).

8625 ON THE ANALYSIS AND INTERPRETATION OF FOIL DATA. Akira Furuhashi (Japan Atomic Energy Research Inst., Tokyo). Nippon Genshiryoku Gakkaishi, 4: 797-807(Nov. 1962). (In Japanese)

Foil techniques play an important role in the experiment in reactor physics. It is always necessary for reactor physicists to compile the newest information on foil techniques in order to conduct fruitful experiments and to make proper interpretation of the results. A short note is presented on the latest papers about the analysis and interpre-

tation of foil data. Information is included on the thermal neutron flux perturbation by foils, neutron self-shielding effect in resonance foils, and effective cadmium cutoff energies. Integral measurements of neutron energy spectra are also discussed with emphasis on the experience accumulated in Japan. (auth)

8626 NEUTRON ENERGY SPECTRA. I. ITS MEASUREMENT IN THE ENERGY RANGE 0.5 TO 15 Mev. R. A. Coombe (Staffordshire College of Tech., Eng.). Nucl. Power, 8: No. 81, 47-50(Jan. 1963).

A review is given of the operation and efficiency of photographic emulsions, cloud and bubble chambers, recoil telescopes, time-of-flight spectrometers, solid-state detectors, scintillation detectors, and He^3 detectors for neutron spectroscopy in the energy range from 0.5 to 15 Mev. (T.F.H.)

8627 MEASURING IN-CORE NEUTRON FLUXES WITH SEMICONDUCTORS. Vladimir S. Ajdačić (Boris Kidrich Inst. of Nuclear Sciences, Belgrade), Richard E. Azuma, and William H. Fleming. Nucleonics, 21: No. 1, 60-2(Jan. 1963).

Spectra minus a tail due to scattering result from improvements in semiconductor technique. The spectra provide information on neutron fluxes and spectra within the core. Targets containing Li^6 and B^{10} are used and the spectra shown. (D.C.W.)

8628 A PORTABLE TRANSISTORIZED SCALER WITH DECATRON READ-OUT. Zbigniew Czech and Leszek Turek (Inst. of Nuclear Research, Krakow). Nukleonika, 7: 527-31(1962). (In Polish)

8629 NUCLEAR COLLISIONS AND IONISATION FLUCTUATIONS IN CHARGED PARTICLE DETECTORS. J. Lindhard and V. Nielsen (Univ. of Aarhus, Denmark). Phys. Letters, 2: 209-11(Oct. 1, 1962). (In English)

A discussion is presented to account for some of the statistics of the basic physical processes occurring in a charged particle detector. It is shown that there may be an appreciable contribution to the reaction width when a heavy charged particle is slowed down. Calculations are presented to give a direct estimate of the energy ending up in atomic motion (ν) from a cascade process. The most probable value of ν (ν^*), the width of the peak around ν^*, and the probability distribution in ν are investigated. The discussion indicates: The effects of nuclear stopping may be eliminated by studying the ionization by impinging electrons or protons. The fluctuation in ionization due to nuclear collisions is strongly dependent on the atomic number of the impinging particle, but is largely independent of its energy and of the stopping substance. The tail of the distribution is more dependent on particle energy and stopping substance. In many cases, the nuclear width $\Delta\nu^*$ may be small compared to the total signal width in a detector, but the tail can remain observable. For ions of high atomic number, or with quite low energies, both the average number of ions and the fluctuations are dominated by nuclear collisions. (H.D.R.)

8630 A NEW TRACK DETECTOR FOR HEAVY PARTICLE STUDIES. P. B. Price and R. M. Walker (General Electric Research Labs., Schenectady, N. Y.). Phys. Letters, 3: 113-15(Dec. 15, 1962). (In English)

When a slab of mica is bombarded with heavy particles and then heavily etched with acid, the particle paths show up as "tracks" which are easily observable in an optical microscope. The quality of these tracks is superior to that produced in conventional nuclear emulsions and the mica is simpler to process and more rugged than emulsions. Examples are presented of particle tracks produced by fission fragments and by recoils induced by 150 Mev O^{16} ions on mica. Because the mica does not register particles with masses $\lesssim 30$, the observed tracks in the latter experiment are due to the heavy nuclear reaction products of O^{16} nuclei with the constituents of mica. The results indicate a compound nucleus formation cross section between 0.15 and 0.3 that of the geometrical cross section for elements with mass ~ 30. The use of this new track registration technique as a method of dating natural mineral crystals and also for measuring low uranium concentrations is briefly discussed. It is pointed out that the particle tracks afford a simple explanation of anomalous etch pits which have been observed in natural mica. (H.D.R.)

8631 PROPORTIONAL COUNTING TECHNIQUE FOR RADIOCARBON MEASUREMENTS. Reidar Nydal (Norwegian Inst. of Tech., Trondheim, Norway). Rev. Sci. Instr., 33: 1313-20(Dec. 1962).

A proportional counting system for radiocarbon dating is described in this article. The CO_2 counter has an effective volume of 1.2 liters and operates at a pressure of 2 atm. The total background is 1.10 counts/min and the standard net count on recent carbon is 16.0 counts/min. Maximum measurable age is 43,000 years. The end terminals of the counter have a few original details which serve to reduce inactive counter volume and the end effects. The ground capacity of the center wire has been reduced to a very small value (10 pf). Anticoincidence shielding is provided by a multiple-anode proportional counter. It is filled with C_3H_8 to a pressure of 1.3 atm and can operate continuously for at least one year without refilling. The counter walls of the ring counter and the CO_2 counter are connected together and supplied with the same high voltage. Shielding against γ rays is provided by a 22-cm-thick iron shield around the counting unit and by a shell of 3.5-cm old lead between the CO_2 counter and the ring counter. (auth)

8632 HIGH GEOMETRY GAS CELL PROPORTIONAL COUNTER. J. D. Ludwick (General Electric Co., Richland, Wash.). Rev. Sci. Instr., 33: 1335-7(Dec. 1962). (HWSA-2647)

A 4-chamber proportional counter was built with very thin windows to detect weak beta radiation in an external gas cell. The instrumental design permits relatively high counting efficiencies and also incorporates an anticoincidence background reduction feature inherent in the detectors' position, with respect to spurious cosmic-ray produced events. Gaseous materials containing the weak beta-emitting radioisotopes Kr^{85}, C^{14}, and H^3 were detected using this instrument. Overall counting efficiencies for these isotopes were 55%, 26%, and 1%, respectively. The specific activity of the material is calculated from PVT data in the sample cell. After calibration, the counter is useful as a means of secondary standardization or where impure gas samples must be tolerated. (auth)

8633 NEW RATIO RATEMETER. Robert Hindel (Atomium Corp., Waltham, Mass.). Rev. Sci. Instr., 33: 1343-9(Dec. 1962).

A new continuous ratio ratemeter is described which gives a linear indication of the single-channel rate divided by the sum rate. The effective time constant of response is derived and the first four statistical moments are calculated for random channel inputs. The predicted performance is verified by the Monte Carlo method and through experimental results. It is furthermore shown that the conventional linear ratemeter is a special case of the more general ratio ratemeter. (auth)

8634 A 4π POSITRON SCINTILLATION SPECTROMETER. J. I. Rhode and O. E. Johnson (Purdue Univ., Lafayette, Ind.). Rev. Sci. Instr., 33: 1410-21(Dec. 1962).

A 4π scintillation-spectrometer system applicable to the measurement of positron spectra is described. It is comprised of a 4π beta-ray detector (two plastic scintillators), three gamma-ray detectors (NaI crystals), and associated pulse-height analysis and coincidence circuitry. Source techniques, calibration procedures, and various pertinent experimental considerations essential to its operation are presented. An evaluation of the system is made on the basis of its performance in the measurement of both positron spectra (Zn^{65} and Na^{22}) and negatron spectra (Pm^{147} and W^{185}). The implications of the experimental results obtained from beta spectra concerning a possible nonlinearity at low energies (<50 kev) in the scintillation response of the plastic phosphor to electrons are discussed. (auth)

8635 IMAGE INTENSIFIER SPARK TUBE. B. Zacharov (CERN, Geneva). Rev. Sci. Instr., 33: 1461-2(Dec. 1962).

A spark chamber is designed for photographic recording of single electrons from the photocathode of a single-stage image intensifier. The chamber has two high-resistance Nesa layers as the electrodes; the first layer is deposited on the outside of the mesh-supported thin mica window, and the second on the inner surface of the chamber end-window. The voltage applied to the chamber is a damped r-f oscillation of ~50 Mc. Very many simultaneous ionizing events can be detected with high efficiency, and a more uniform distribution of light intensity is also obtained. The results of a test with cosmic rays are described. (D.L.C.)

8636 TECHNIQUE, INDICATIONS, AND LIMITATIONS OF SCINTIGRAPHY. W. Sinner (Universität, Zurich). Schweiz. Med. Wochschr., 91: 1494-1503(Dec. 9, 1961). (In German)

Various aspects of scintiscanning are discussed, including historical development, physical principles, and technical methods. (H.H.D.)

8637 LIGHT-WEIGHT RATE METER FOR NEUTRON SOIL MOISTURE MEASUREMENT. C. H. M. van Bavel (U. S. Department of Agriculture, Tempe, Ariz.). Soil Sci., 94: 418-19(Dec. 1962).

An improved rate meter weighing only 7 lb is described and its characteristics discussed briefly. Its precision is 2 cps, equivalent to ~0.5 vol % moisture content. It has been tested successfully for more than 1 year in field use under the extreme conditions of Arizona weather. (D.L.C.)

8638 TRANSISTORIZED HAND, FOOT AND CLOTHING MONITOR. Taro Oba (Tokyo Shibaura Electric Co., Ltd.). Toshiba Rev. Intern. Ed., No. 11, 39-42(1962). (In English)

A subject steps on the grille of the foot stand of this instrument and inserts his hands into the hand taps. Then the degree of contamination of his hands and feet will be automatically counted and indicated: "good" when it is under the permissible level, and "bad" when it is above that level; and in the latter case an alarm is given. The contaminated clothing can be likewise detected by unhooking the clothing probe which is hung in front of the panel and surveying the clothing with it. This hand, foot, and clothing monitor, being an assembly of several all-transistorized plug-in units, is characterized by exceedingly high reliability and extremely small power consumption. (R.J.S.)

8639 CALORIMETRIC DEVICE FOR MEASURING RADIUM PREPARATIONS. L. P. Timofeyeva and E. A. Khol'nova. Tr. Inst. Kom. Standartov, Izmeritel. Priborov Sov. Min., No. 55(115) 5-34(1961).

A detailed description of the design, theory, calibration, and operation of a calorimetric device developed and intended for measuring the absolute activity of α preparations (particularly Ra preparations) is given. The device can also be used as a β calorimeter, in which case the α-glass envelopes are suitably replaced. The measuring device consists of a β calorimeter and two independent static-type α calorimeters, intended for measuring differently sized radium ampoules. The device consists of the following basic parts: two Cu cylinders with the calorimeters; a water thermostat; an electric device for measuring calorimeter temperature; a potentiometric system for calorimeter calibration; a system for measuring the sensitivity of the galvanometer; and a device for regulating the liquid level in the thermostat. Experiments established that the sensitivity of the calorimeters permits measuring Ra preparations in the 0.1 mC to 1 C range and measuring β preparations in the 5 to 10 Mc to 3C range. An analysis of the method of measuring the absolute activity of Ra preparations and of the sources of possible errors showed that the error does not exceed ±0.8 to 1.0%. The advantages of absolute calorimetric measurements for determining the activity of non-standard Ra preparations are discussed. Experiments carried out with the α calorimeters were: absolute and relative measurements of a standard Ra preparation; measurement of the absolute activity of a set of highly active standard Ra preparations; and comparative study of four Ra gages. (P.C.H.)

8640 INVESTIGATION OF A FLAT SLOW NEUTRON SCINTILLATOR. E. P. Andreyev, S. S. Rodionov, and I. A. Yaritsyna. Tr. Inst. Kom Standartov, Izmeritel. Priborov Sov. Min., No. 55(115) 66-8(1961).

Investigations were made on a luminescent detector of slow neutrons. The study was conducted in order to determine the efficiency of the detector and also its sensitivity to γ rays. A block diagram of the experimental installation is included. The experiments proved that at a dose rate of 5×10^3 M r sec^{-1} the detector is practically insensitive to γ rays. The efficiency of the detector, as regards thermal neutrons, was determined by the ratio of counted pulses to thermal neutrons per unit of time. The neutron flux was determined on the basis of the absolute activity of an In foil placed directly on the detector, the activity being measured with a 4π-counter. The expression for the efficiency of the detector is $\epsilon = (N_0 \cdot 100/\phi_T S$ (N_0-number of counted pulses per minute found to be equal to 5624; S-area of the photocathode = 9 cm^2; ϕ_T-thermal neutron flux established at 1.3×10^4 neutrons/min^{-1}/cm^{-2}). Hence $\epsilon = (5624 \cdot 100/1.3 \cdot 10^4 \cdot 9) = 4.7\%$. The error was established at ±0.3%. (P.C.H.)

8641 THE 4π-FLOW PROPORTIONAL COUNTER FOR MEASURING LOW ACTIVITY LEVELS. K. A. Petrzhak and R. F. Sedletskii. Tr. Leningr. Tekhnol. Inst. im. Lensoveta, No. 55, 32-8(1961).

The design and characteristics of a 4π-flow proportional counter intended for measuring low activity levels are described. The spherical shape of the counter makes it possible to reduce to a minimum the harmful surface of lead-in insulators by applying the loop system of anodes. The background obtained with the counter in an underground room behind a protection of 2-cm lead, 15-cm steel, and 1.6-cm brass amounted to 5 to 7 pulse/min. Investigations were made on the dependence of counter characteristics (value of operating potential, length and slope of the plateau) on the percentage content of methane in a mixture with Ar, filament thickness, loop diameter, arrangement of the loop, and mechanical and thermal treatment of the filament. (Referativnyy Zhurnal, Fizika, No. 1, 1962)

8642 HIGH-PRESSURE PROPORTIONAL COUNTER FOR LOW ACTIVITY MEASUREMENTS. G. Mirianashvili and A. Burchuladze. Tr. Tbilissk. [Gos.] Univ., 86: 305-12(1960).

A proportional counter designed for low activity measurements (mainly of C^{14}) is described. The counter cathode is made from a 60-cm long Cu tube of 11.5-cm inside diameter. A W filament, 0.035 mm in dia., is the counter anode. To dispose of spurious pulses, the anode is surrounded by a guard ring and drawn through a plexiglass insulator. The counter cross section is presented. The pulse from the counter is fed to a scaler through the preamplifier and the main amplifier. The cathode-ray oscilloscope is used to determine the proportional region. The dependences of counting rate on counter voltage when filling the counter with CO_2 to pressures of 1.5 and 3 atm under different conditions of irradiation are indicated. The plateau of the voltage-to-counting rate characteristic extends from 200 to 400 v. (Referativnyy Zhurnal Fizika, No. 6, 1962)

8643 THE RESPONSE OF A NaI(Tl) SCINTILLATION CRYSTAL IN THE ENERGY RANGE OF THE K AND L ABSORPTION BOUNDARY OF THE IODINE (33.2 OR 5.2 kev) FOR X RAYS. W. Hink (Freie Universität, Berlin). Z. Physik, 169: 370-85(1962). (In German)

The response of a NaI(Tl) crystal to x rays is measured in the energy region from 3 to 46 kev with a single channel pulse-height analyzer. The x rays of the different photon energies are produced by excitation of fluorescence radiation of the elements potassium to dysprosium. A proportionality with energy results only in approximation. For photon energies which correspond to the excitation level of the L or the K shell of iodine a minimum of the average pulse-height per unit energy $\overline{H}/E$ which is proportional to the scintillation efficiency occurs in the energy dependence. The response to electrons is deduced from the response to x rays. The behavior of $\overline{H}/E$ for x rays is attributed to the energy dependent scintillation efficiency of the NaI(Tl) crystal for electrons. (auth)

8644 CALCULATION OF PULSE-HEIGHT DISTRIBUTIONS AND COUNTING EFFICIENCIES OF A FAST-NEUTRON SCINTILLATION DETECTOR. V. G. Zolotukhin, G. G. Doroshenko, and B. A. Efimenko (Academy of Sciences, Moscow). IAEA Preprint SM-36/19. 19p. (In Russian)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

An effective method was developed for calculating the amplitude distribution of scintillation-detector pulses with irradiation by monoenergetic neutrons. The method is based on separation of the contributions to the amplitude distribution from single and multiple neutron interactions with the nuclei of the scintillator substance. The contribution from single scattering is calculated analytically and that from multiple scattering is calculated by the Monte Carlo method. With scintillators which are not too big this method gives a considerable increase in accuracy as compared with the normal Monte Carlo method. A number of effects not dealt with in previous works are given (anisotropy of inelastic scattering in carbon and of n-p scattering in hydrogen, anisotropy of boundary effects at the end and at the side-wall of a cylindrical crystal). The method can be used for any size of crystal and the results of the calculations can be used for any practical scintillation counter (with a given energy resolution and a known relation between the light yield and the proton energy). Numerical results are given for a Stilbene crystal (ϕ = 30 mm). The initial neutron energy in the range 0.5 to 18 Mev was chosen taking into account the resonance character of the carbon cross-section, which made it possible to obtain details of the change in counting efficiency as a function of the threshold and of the primary energy of the neutrons. The calculations made form a basis for obtaining information on fast neutron spectra from experimental data. (auth)

8645 METHODS OF FAST-NEUTRON SPECTROMETRY AND THE OPPORTUNITIES FOR THEIR USE IN NEUTRON DOSIMETRY. E. L. Stolyarova. IAEA Preprint SM-36/20. 24p. (In Russian)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A short account of existing methods of fast neutron spectrometry is given (time of flight, nuclear reactions, and recoil nuclei methods). A critical analysis is given of modern spectrometric equipment (e.g., crystal semiconductor and scintillation detectors, in particular those based on differences in scintillation decay times for heavy charged particles and electrons etc.). Various possible ways of using spectrometric methods to solve two main problems in fast neutron dosimetry are considered. (auth)

8646 A NEW METHOD FOR STUDYING CONTINUOUS FAST NEUTRON SPECTRA. THE COUNTING EFFICIENCIES METHOD. G. G. Doroshenko, V. I. Glagolev, I. R. Barabanov, and I. V. Fililyushkin. IAEA Preprint SM-36/15. 10p. (In Russian)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A new method of continuous-spectrum spectrometry is discussed, which is based essentially on the known energy and threshold dependence of fast-neutron counting efficiencies and on experimentally measured integral count rates at appropriate energy thresholds. The proposed method has the following advantages: possibility of using a detector with any line shape; shorter time for obtaining the information, thanks to better statistical accuracy of the experimental data and use of the entire spectrum of the apparatus; ease of processing of the results. The method described can be employed to design portable equipment for use in applied spectrometry. The method can be used with scintillation detectors and also with hydrogen and helium chambers. Various ways of processing the experimental data are considered and their advantages and disadvantages are enumerated. Experimental fast neutron spectra are given, showing good agreement with known spectra. (auth)

8647 THEORY OF NEUTRON-ELEMENT BASED ON EXPERIMENTS WITH GAMMA-ELEMENT. R. Hosemann and H. F. H. Warrikhoff (Max-Planck-Gesellschaft, Berlin). IAEA Preprint SM-36/25. 15p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

So-called "radiation elements" belong to that type of detectors which convert radiation energy directly into electric energy without any subsidiary voltage. There has already been perfected a special construction of a gamma element which consists of a two-electrode system (two coaxial hollow cylinders) connected by an electrometer, both built into a vacuum cell. These elements show a satisfactory energy independence and are specially suited for individual dosimeters, because of the fact that a battery or auxiliary tension is not necessary. Furthermore, they can quantitatively measure high dose rates, because there are

no ion pairs created and, hence, no saturation effects occur. The neutron elements work in a manner similar to gamma elements, so that all evaluations performed as well as constructions and measuring systems developed can be used in both cases. For the function of the radiation elements it is necessary, that the one electrode when bombarded emits a greater number of charged particles than the other. Some possibilities are discussed for the conversion of charged particles by neutrons. The attainable sensitivities are roughly estimated and supports for the energy dependence (respective to rem-unit) are given. Technological problems connected with each type of electrode and ways for smoothing the energy dependence are explained. From the experimental data on gamma elements one can evaluate the optimal thickness of the electrodes, scale-end values and other characteristics, such as leakage after radiation, quality of the vacuum, etc. (auth)

8648 MEASUREMENT OF NEUTRON SPECTRA BY A PROTON RECOIL TELESCOPE AND BY THE NUCLEAR EMULSION METHOD. K. W. Geiger (National Research Council, Ottawa). IAEA Preprint SM-36/35. 8p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A recoil counter telescope and the nuclear emulsion method have been evaluated in their performance for spectral and intensity measurements from point sources of neutrons. Both methods make use of the analysis of proton recoils in hydrogeneous material. In nuclear emulsions the recoils are released as well as analyzed within the same material. This approach cannot easily be realized in a recoil spectrometer. In the particular spectrometer used, recoils from a thin solid hydrogeneous radiator are accepted within a cone of half-angle of 18 degrees by a counter telescope. The particles pass through two proportional counters to identify them as protons and are then totally absorbed in a CsI scintillation crystal and their energy determined. The two methods are compared with each other regarding their convenience of operation, spectral resolution, efficiency, energy range covered, background effects, gamma discrimination, etc. The experimental data include the spectra from radioactive Po^{210}-B(α,n) neutron sources and from the D + T reaction. Neutron flux data were also obtained and are further compared to energy independent source calibrations carried out in a manganese sulphate bath. The spectrum from a Po-B^{10}(α,n) source is particularly interesting in that this is the only common (α,n) source type which shows no more than a single peak with a reasonably narrow half-width (40%). This source is therefore suitable for certain neutron calibration work. (auth)

8649 SIMPLIFIED PROTON RECOIL "TELESCOPE" FOR REACTOR BEAM FAST NEUTRON SPECTROMETRY. S. B. Herdade, S. Paiano, A. A. Suarez, and O. Y. Mafra (Instituto de Energia Atômica, São Paulo, Brazil). IAEA Preprint SM-36/99. 8p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

A simplified proton recoil "telescope" was developed which presents relatively good resolution with an efficiency high enough for measurements in reactor beams whose fluxes are of the order of 10^6 n/cm^2/sec. Good resolution is achieved by the use of thin polyethylene radiators and small detection solid angle. Background discrimination, usually provided by coincidence measurements, is here attained by a careful design of the recoil chamber. The principal features of the chamber are: (a) large size, in order to avoid wall scattering; (b) proton detector located out of the reactor beam; (c) operation in vacuum, providing a free path for the recoil protons from radiator to detector; and (d) detector collimator and shield made with high Z material. Fast neutrons undergo n-p scattering in a thin polyethylene foil and the recoil protons emerging at an angle $\theta = 20°$ with the direction of the incident neutron beam are detected by a CsI(Tl) scintillator. Protons lose almost all their energies in the CsI(Tl) crystal and the energy distribution is determined by pulse height analysis in a multichannel analyzer. Neutron spectra can be deduced from proton energy distribution through the relation $E = E \cos^2 \theta$. At neutron energies ranging from 2 to 12 Mev the detection efficiency varies from 10^{-5} to 10^{-7} and the chamber intrinsic resolution is of the order of 8%. (auth)

8650 IONIZATION CHAMBERS IN NEUTRON DOSIMETRY. H. H. Rossi (Columbia Univ., New York). IAEA Preprint SM-36/85. 13p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Because of their simplicity and reliability, ionization chambers are very convenient instruments for radiation dosimetry. In particular, the tissue equivalent ionization chamber, if properly designed and employed, may be utilized for accurate absorbed dose determinations over a wide range of radiations and dose levels. Because of its universal response, this chamber provides no significant discrimination between doses due to individual radiations in mixed radiation fields. However, in the case of simultaneous irradiation by neutrons and gamma rays, one usually wishes to determine at least the dose separately contributed by each radiation. Further detail is desirable since the common assumption of an RBE of 10 for fixed neutrons is, in fact, a conservative oversimplification. Thus, while tissue equivalent ionization chambers of a variety of designs can be used singly in relatively pure radiation fields, they must be supplemented by other devices in order that a satisfactory assessment of a mixed radiation field be performed. One approach extensively employed in the past has been to use chambers that have unit sensitivity to x- and gamma-radiation but little sensitivity to neutrons. The neutron response of such chambers when made of graphite or conducting teflon and filled with CO_2 varies between negligible values and about 15% if the neutron energy increases from about 100 kev to 14 Mev. Since over this range the RBE of neutrons (as recommended in protection regulations) decreases by about 35%, it is possible to utilize a combination of similar tissue equivalent and teflon chambers to perform a rather precise assessment of RBE dose in mixed radiation fields of any relative intensity. The principles of this approach are outlined and a variety of chamber designs are presented. (auth)

8651 NUCLEAR INSTRUMENTS AND THEIR USES. VOLUME I. IONIZATION DETECTORS, SCINTILLATORS, ČERENKOV COUNTERS, AMPLIFIERS: ASSAY, DOSIMETRY, HEALTH PHYSICS. Arthur H. Snell, ed. New York, John Wiley & Sons, Inc., 1962. 499p. $7.50.

Seven papers are presented on the nuclear detectors most commonly used in counting experiments, radiochemical work, and health physics. Some information is given on the tolerance limits of radioactivity. Separate abstracts were prepared for six of the papers; the remaining paper was previously abstracted in NSA. (D.L.C.)

8652 PULSE IONIZATION CHAMBERS AND PROPORTIONAL COUNTERS. Wolfgang Franzen (Boston Univ.) and L. W. Cochran. p.3-81 of "Nuclear Instruments and Their Uses. Vol. I." New York, John Wiley & Sons, Inc., 1962.

The operation of the pulse ionization chamber and proportional counter is discussed in detail. Among the items discussed are the creation and life history of ions, the nature of observed signals, and the wall effect. Finally, the types of detectors and techniques are considered. (D.L.C.)

8653 SCINTILLATION COUNTERS. R. B. Murray (Oak Ridge National Lab., Tenn.). p.83-165 of "Nuclear Instruments and Their Uses. Vol. I." New York, John Wiley & Sons, Inc., 1962.

A review of currently used techniques and developments in scintillation counters is presented. The history and advantages of scintillation counters are described briefly. Inorganic crystals, organic crystals and plastics, organic liquids, and noble gases are considered in detail. Finally, photomultiplier tubes, counter assembly, and applications of scintillators are discussed. (D.L.C.)

8654 A SURVEY OF ĈERENKOV COUNTER TECHNIQUE. Burton J. Moyer (Univ. of California, Berkeley). p.166-93 of "Nuclear Instruments and Their Uses. Vol. I." New York, John Wiley & Sons, Inc., 1962.

The characteristics of Ĉerenkov radiation are discussed. Focusing and nonfocusing Ĉerenkov counters are described. Efficiency and resolution considerations are discussed. (D.L.C.)

8655 ELECTROMETERS AND AMPLIFIERS. Edward Fairstein (Oak Ridge National Lab., Tenn.). p.194-305 of "Nuclear Instruments and Their Uses. Vol. I." New York, John Wiley & Sons, Inc., 1962.

A detailed review of d-c electrometers and pulse amplifiers is presented. Quartz-fiber, Lindemann, vacuum-tube, and vibrating-capacitor electrometers are considered, and practical aspects of electrometer circuits are discussed. Total activity measurements and pulse shaping in amplifiers are discussed, and other aspects of amplifiers discussed are clipping networks, blocking, noise reduction, tubes, and linearity. (D.L.C.)

8656 APPLICATIONS TO RADIATION DOSIMETRY. G. S. Hurst and R. H. Ritchie (Oak Ridge National Lab., Tenn.). p.367-90 of "Nuclear Instruments and Their Uses. Vol. I." New York, John Wiley & Sons, Inc., 1962.

A review is presented on the fundamental concepts, trends, and instrumentation in the dosimetry of gamma rays and neutrons. (D.L.C.)

8657 TECHNIQUES OF PERSONNEL MONITORING AND RADIATION SURVEYING. Karl Z. Morgan (Oak Ridge National Lab., Tenn.). p.391-469 of "Nuclear Instruments and Their Uses. Vol. I." New York, John Wiley & Sons, Inc., 1962.

Various aspects of health physics are discussed, and a proper health physics program for small institutions is outlined. Various levels of radioactive intensity and maximum permissible levels of radiation exposure are described. Instruments for monitoring radioactivity are described. Special monitoring problems, waste disposal, and emergency precautions are considered. (D.L.C.)

8658 THE USE OF PHOTOCELLS IN COMBINATION WITH PHOSPHORS FOR RECORDING BETATRON, GAMMA AND X-RAY RADIATIONS. A. A. Samokhalov and I. G. Fakidov. p.52-5 of "Betatronnaya Gamma-Defektoskopiya Stali." Moscow, Academy of Sciences, 1961.

A Se photocell and vacuum phototube were used, in combination with phosphors as detectors of γ radiations, for recording the γ radiation of a betatron (from 22 Mev to 0) and Co^{60} isotope and the x radiation. The current of the photocell was recorded with a galvanometer. Data are presented on the sensitivity to the radiations, arising in different combinations of the photocell with phosphors. The results revealed that it is possible to build detectors for the γ radiation of a betatron and Co^{60} and x radiation when combining the photocell with various phosphors. Their sensitivity depends on the hardness of the radiation, and equals 10^{-8} (a)/(p/min) when using a Se photocell, and 10^{-10} (a)/(p/min) when using a vacuum phototube. It is shown that the simple phosphor-photocell-galvanometer device may serve as a monitor for medium and highly intensive radiations. (Referativnyy zhurnal, Metallurgiya, No. 7, 1962.)

8659 GAMMASPECTROMETRY OF RADIOISOTOPES. D. De Soete and J. Hoste. p.59-63 of "1961 International Conference on Modern Trends in Activation Analysis, held December 15-16, 1961 at College Station, Texas."

According to Peirson, net photopeaks can be obtained by subtracting the Compton continuum of the NaI (Tl) detector by means of an anthracene crystal. It could be shown that better compensation of the Compton edge is obtained if the anthracene is substituted by a plastic detector, which furthermore reduces the detector cost by a factor of approximately fifty percent. With the detectors mounted in a lead castle at a 180° angle considerable interference is still encountered by backscatter. Further improvement is achieved by mounting the detectors at a 90° angle and by shielding with lead collimators. When net photopeak gamma spectra are obtained, it becomes possible to predict when 2 gamma lines can be resolved. The knowledge of the resolution as a function of gamma energy is therefore required. It could be shown that, for energies between 100 kev and 2 Mev, which is the most useful region, the resolution can be computed from the empirical relation: $R^2 = C + C'E^{-1}$. Identification of the two adjacent gammas is assumed to be possible if they give rise to a peak-to-valley ratio of at least 2. It can be shown that the required energy difference ΔE between the two gammas of respective energies E_1 and E_2 and peak heights h_1 and h_2 will approximately be given by: $\Delta E \geq (1.41E)/(200)\ [C + C'E^{-1}]^{1/2}\ \{1 + [1 + 1.66 \log (h_{1(2)})/(h_{2(1)})]^{1/2}\}$, where $h_1 \geq h_2$ or $h_{(2)} \geq h_{(1)}$. If count rates are computed from the peak heights, it is evident that interference will occur if the resolution is incomplete. If one admits a per cent interference z for h_1, the required energy difference is given by $\Delta E = (E/200)\{C + C'E^{-1}\}^{1/2}\ \{n + 3.32 \log (h_2)/(h_1)\}^{1/2}$, where n = 1; 3.32 and 6.64 for z = 50; 10 and 1%. The above theory is illustrated by a number of practical examples. (auth)

8660 SEMICONDUCTOR ELECTRONICS IN THE DOSIMETRY OF PENETRATING RADIATION. I. G. Nekrashevich. Materialy Nauchn.-Tekhn. Konf., Belorussk. Resp. Pravlenie Nauchn.-Tekhn. Obshchestva Radiotekhn. i Elektrosvyazi, Minsk, 1960, 11-20[1960].

Uses of semiconductors as radiation pickups in dosimetric devices are described. In such pickups, either radioactive pulses are transformed into electric pulses (in a circuit using the energy of a local source), or the pickup itself becomes a source of electric energy under the action of particle or photon flux. The action principle of pickups of the former type is analogous to that of gas-discharge Geiger counters. Pickups of the latter type are semiconductor valve elements. The main requirements that the pickups should meet are: changes produced by

radiation in the pickup should be reversible; the equilibrium state of the pickup after switch-on and switch-off of radiation should be established within a sufficiently short time; while sufficiently sensitive to radiation, the pickup should be insensitive to other external influences (temperature, pressure, magnetic and electric fields); a sufficiently simple relationship (linear dependence) between the value of measured radiation and changes in pickup sensitivity parameters is desirable; and in many cases it is desirable that the pickup should record the pulses of the individual ionizing particles or photons. Among the materials that more or less satisfy these requirements, semiconductors rank first, both in the form of monocrystalline and polycrystalline specimens. Those examined most are Cu_2O, Se, CdS, CdSe, PbS, Ge, and Si. CdS and CdSe rank first as to sensitivity. However, they are highly inert in the x and γ ranges (of the order of tens of minutes), and therefore cannot be used for recording radiation in these ranges. Another way of working out semiconductor pickups for ionizing radiation consists in using semiconductor contact systems with an n-p junction in the contact zone (valve elements). The greatest inconvenience of such elements in recording particles or photons of very high energies is the lengthy or even irreversible change of the n-p junction properties, due to coarse lattice damage. These damages are absent, however, in the case of particles with the energy $h\nu < 1$ Mev. Another disadvantage of valve elements in the x and γ ranges is their low efficiency, related to the high penetrating power of these rays. The efficiency can be raised by passing a particle or photon beam through a column of thin-layer series-connected valve elements. Some characteristics of such valve-element batteries are indicated. (OTS)

8661 SPECTRUM ANALYSIS OF FAST NEUTRONS USING THE $Li^6(n,t)He^4$ REACTION. C. Beets and M. Lott (EURATOM. Brussels). IAEA Preprint SM-36/107. 19p. (In French)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

The possibilities of the $Li^6(n,t)He^4$ reaction in the spectrum analysis of fast neutrons are shown. The techniques used are described and results are presented. The techniques make use of fine-grain (Ilford Ltd.) and superfine grain (S. A. Gevaert) emulsions charged with lithium, and of junctions (solid state ionization chambers); the characteristics reached by the junctions made in the laboratories are specified. Two cases are considered in applying spectrometry. In the first, the neutron energy is deduced from the law of conservation of energy; in the second, the neutron spectrum is deduced from the triton spectrum, the irradiation geometry being known. (auth)

8662 THORIUM FISSION DOSIMETRY OF FAST NEUTRONS. S. May and G. Pinto (Centre d'Étude Nucléaires, Saclay, France). IAEA Preprint SM-36/93. 8p. (In French)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

The use of thorium dosimetry for long irradiation periods is described. The method of measurement adopted was quantitative determination of a fission product with a high fission yield, Cs^{137}. After irradiation, a thorium sample (~10 to 20 mg) is treated with HCl in the presence of an inactive cesium carrier and the cesium phosphotungstate precipitated out. The precipitate is purified by repeated dissolution in soda and reprecipitation, with scavenging of the foreign radioelements on ferric hydroxide as an intermediary operation. The radioactivity of the cesium phosphotungstate precipitate is analyzed on a multi-channel gamma spectrograph and the absolute activity of the Cs^{137} then deduced by comparison, thus making it possible to calculate the value of the fast neutron flux. The difficulties of the method lie in the high activity of the Pa^{233} produced during irradiation of the thorium and in knowing the fission cross section under irradiation conditions. Several sets of data are given for different irradiation conditions, parallel with thermal neutron dosimetry using Co^{60}. (auth)

8663 IMPROVEMENTS IN OR RELATING TO NUCLEAR PARTICLE DISCRIMINATORS. Peter Alfred Egelstaff and Leonard Arthur Wraight (to United Kingdom Atomic Energy Authority). British Patent 911,116. Nov. 21, 1962. Filed Sept. 20, 1960.

The discriminator utilizes differences in the shapes of scintillation pulses produced by different kinds of particles. The apparatus consists of a scintillation counter including a photomultiplier tube and a phosphor. (R.J.S.)

8664 AUTOMATIC SAMPLE CHANGER TO BE USED IN CONNECTION WITH AN APPARATUS FOR MEASUREMENT OF RADIOACTIVITY. Joergen Emil Lippert and Arne Soerensen (to Atomenergikommissionen of Sdr. Ridebanefij). British Patent 911,550. Nov. 28, 1962. Priority date June 27, 1958, Denmark.

A number of sample holders are adapted to receive radioactive samples. Projecting pins are provided to transmit information for programming the measuring apparatus. (R.J.S.)

8665 ULTRASONIC NEUTRON DOSIMETER. (to U. S. Atomic Energy Commission). British Patent 912,644. Dec. 12, 1962. Priority date Feb. 27, 1959, United States.

An apparatus is designed for neutron dosimetry using ultrasonic waves. In the apparatus, a transducer is ultrasonically coupled to a borosilicate glass, and the effects of the neutron dose received by the glass on the transmission of ultrasonic waves in the glass is used as a measure of the neutron dose. (D.L.C.)

8666 IMPROVEMENTS RELATING TO APPARATUS FOR DETECTING IONIZING RADIATION. (to Minneapolis-Honewell Regulator Co.). British Patent 913,551. Dec. 19, 1962. Priority date June 12, 1957, United States.

A fire and flame detecting apparatus using a Geiger-Muller sensor is designed. The sensor is arranged in a circuit to produce a pulsating signal when exposed to ionizing radiation, and the signal is fed to a switching circuit through two separate channels which are integrating or delay networks with different delay degrees. The switching circuit delivers an output only receiving signals simultaneously from both channels. (D.L.C.)

8667 SWITCHING ARRANGEMENT FOR RADIATION METERS WHICH MEASURE RADIATIONS BY MEANS OF GEIGER-MULLER COUNTERS. Rolf Mohring (to Veb Vakutronik). British Patent 913,743. Dec. 28, 1962. Filed Apr. 6, 1960.

A part of the counting tube pulses is caused to become small in amplitude if the radiation becomes very strong. The monostable multivibrator will no longer trip under these conditions. This has the effect of reducing the indicator pulse density. (R.J.S.)

8668 WEB MATERIAL FOR IRRADIATION TESTING. Eldred Vaughan Southam, Geoffrey Arthur Dawe, and Charles Edward Pegg (to Adhesive Tapes Ltd.). British Patent 913,962. Dec. 28, 1962. Filed Mar. 17, 1960.

An irradiation test element or meter is comprised of a support web patterned with two coloring agents exhibiting a differential response to gamma radiation. (R.J.S.)

8669 INDICATORS, COUNTERS AND OTHER INSTRUMENTS OPERATED BY THE AID OF BETA OR GAMMA RADIATION. Peter Kenneth Tomkins (to Burndept Ltd.). British Patent 914,181. Dec. 28, 1962. Filed July 16, 1959.

Means are provided for indicating the presence of a material object at a particular position comprising a source of beta or gamma radiation on one side and a radiation detector, such as a Geiger tube, on the other side of the position. An integrating circuit, a comparator circuit, and a relay circuit are described. (R.J.S.)

8670 FISSION CHAMBER. (to United Kingdom Atomic Energy Authority). French Patent 1,275,737. Oct. 2, 1961. Priority date Dec. 11, 1959, Great Britain.

For measuring the neutron flux inside a nuclear reactor a high-temperature fission chamber is used comprising a tube having at one of its ends introduced into the reactor core a region constituting the fission chamber. Furthermore, the tube has a supporting region connecting the chamber with a remote spot, while a metallic wire stretches from a central electrode, insulatedly mounted inside the chamber, to the remote spot. A layer of fissile material is provided in the proximity of the chamber formed by the central electrode and the tube. The construction is such as to allow gas flow between the regions of the tube, the gas being or containing xenon. (IIB)

8671 RECYCLING RADIATION RATE METER. Edward J. Wesley. U. S. Patent 3,050,625. Aug. 21, 1962.

A meter is described which requires a minimum of parts and power for completely portable operation. (R.J.S.)

8672 SEWAGE SLUDGE DENSITY MEASURING APPARATUS. Philip E. Ohmart and Henry L. Cook, Jr. (to Ohmart Corp.). U. S. Patent 3,070,692. Dec. 25, 1962. Filed Feb. 19, 1960.

A transition pipe section is placed in the sludge pipe line. A radioactive source is mounted on one side of the transition section and a radiation detector is placed on the opposite side. Current flow produced in the detector is correlated with the sludge density. (R.J.S.)

8673 SCINTILLATION SCANNER. Joseph B. Stickney, Clarence E. Lemmermann, and Carl E. Herring (to Picker X-Ray Corp., Waite Mfg. Div., Inc.). U. S. Patent 3,070,695. Dec. 25, 1962. Filed June 1, 1959.

A portable mechanism has been designed to move a scintillation scanner over the body of a patient and produce graphic and photographic reproductions of the measured radioactivity. The probe is supported cantilever fashion on a boom which also supports a light source and a stylus. The boom is connected to an automatic drive to move the probe through a predetermined pattern for a tracer study. (R.J.S.)

8674 RADIOACTIVE SOLID PARTICLES FOR USE IN WELL LOGGING. Cassius R. McEwen (to Union Oil Co. of California). U. S. Patent 3,070,696. Dec. 25, 1962. Filed Sept. 19, 1955.

A method of logging boreholes involves introducing into the bore a fluid in which is suspended a finely divided synthetic resin selected from the class consisting of polyethylene and non-ion-exchanging polyvinyl resins. The synthetic resin is previously rendered radioactive by treatment with a radioactive halogen. The fluid is forced into the strata by applied pressure; the radiation from the deposited resin particles is subsequently monitored and variations are determined. (R.J.S.)

8675 QUANTUMMECHANICAL COUNTERS. Nicolaas Bloembergen (to Schlumberger Well Surveying Corp.). U. S. Patent 3,070,698. Dec. 25, 1962. Filed Apr. 17, 1959.

A system is described for detecting electromagnetic quanta in the infrared or millimeter wave spectrum. The system may be operated continuously over a period of time without requiring renewal or replacement of a detecting element. Incident quanta outside the visible spectrum are converted to visible quanta. The system is free of noise in the absence of infrared or millimeter wave quanta for enhanced low-level resolution of incident radiation. (R.J.S.)

8676 SELECTIVE SIGNAL DETECTOR. Raymond C. Waddel (to U. S. Navy). U. S. Patent 3,071,688. Jan. 1, 1963. Filed Apr. 30, 1959.

A radiation detector system is designed for detecting a desired radiation among more intense radiation, particularly beta particles in a background field of gamma rays. The system is based on the method of altering the radiation path to absorb periodically the desired radiation and cancelling out the pulses due to the background with pulses of opposite polarity. In the embodiment for detecting betas in a gamma field, the radioactive air is pumped through a filter placed in the path of a scintillation detector. The detector output is amplified and fed to a pulse generator having electric charges of both polarities, and the resulting pulses are stored in a condenser. The radiation incident on the detector is modulated by a rotating absorber. When the absorber is in the radiation path, the gammas but not the betas are detected, and a cam actuates a double throw switch to reverse the polarity of the pulses from the pulse generator. Thus, the pulses due to the gamma radiation are cancelled out. (D.L.C.)

8677 APPARATUS FOR CYCLIC ACTIVATION LOGGING. Eric C. Hopkinson and Robert L. Tucker (Well Surveys, Inc.). U. S. Patent 3,072,790. Jan. 8, 1963. Filed Mar. 13, 1959.

A well logging apparatus is described which includes an accelerator-type neutron source and means for cyclically operating the source and the associated apparatus. (R.J.S.)

8678 RADIOACTIVITY WELL LOGGING. Hugh E. Hall, Jr. (to Texaco Inc.). U. S. Patent 3,072,791. Jan. 8, 1963. Filed Dec. 7, 1959.

A source of neutrons is employed to produce an observable effect indicative of the nature of formations penetrated by a bore hole. Neutrons emitted by the formations are detected by a gamma radiation counter. (R.J.S.)

8679 RADIOACTIVITY WELL LOGGING. Hugh E. Hall, Jr. (to Texaco Inc.). U. S. Patent 3,072,793. Jan. 8, 1963. Filed Dec. 7, 1959.

A source of neutrons is employed to produce an observable effect indicative of the nature of formations penetrated by a bore hole. Neutrons emitted by the formations are detected by a beta radiation counter. (R.J.S.)

8680 SHOCK-RESISTANT SCINTILLATION METER COMPONENT. Roland W. Carlson and Richard D. Platt (to Harshaw Chemical Company). U. S. Patent 3,073,954. Jan. 15, 1963. Filed June 23, 1959.

A luminophore-photomultiplier tube assembly is designed in which the tube does not have to be made to close dimensional tolerances. In making the assembly, the

phototube and luminophore are optically coupled with an epoxy resin, the assembly is placed in an aluminum container, the space between assembly and container is filled with a reflective alumina or magnesia packing, and the assembly is sealed with a flexible rubber potting seal. (D.L.C.)

8681 GAMMA RADIATION DOSIMETER. Denver Hale. U. S. Patent 3,073,955. Jan. 15, 1963. Filed Apr. 26, 1960.

A small colorimetric dosimeter of the glass-dye type is described for use in the range 10^7 to 10^9 ergs/g. The dosimeter comprises a porous, cellular silica matrix containing a radiation-sensitive dye within its pores. The matrix has a density of ~1.45 and a developed surface area ~200 m^2/g, and the dye is one of the following: methylene blue, basic fuchsine, fluorescein, rhodamine B, fast red S, and brilliant green. Working absorbance vs dose curves are given for different dyes. (D.L.C.)

8682 NUCLEAR INSTRUMENTATION. Robert R. Hoge (to Bendix Corp.). U. S. Patent 3,073,956. Jan. 15, 1963. Filed Apr. 30, 1959.

A nuclear instrumentation system is designed for amplifying a small current from an ionization chamber. In the system, a semiconductive bridge circuit is used to invert a small d-c to an amplified a-c which is further amplified, phase inverted, and then rectified to d-c. A high-frequency oscillator source is connected across the arms of the bridge circuit. (D.L.C.)

8683 FLUX SCANNING EQUIPMENT FOR NUCLEAR REACTORS. Max William Jervis (to A.E.I.-John Thompson Nuclear Energy Company Limited). U. S. Patent 3,073,959. Jan. 15, 1963. Priority date Oct. 18, 1957, Great Britain.

An apparatus for determining the flux density distribution in a reactor core is designed which lowers a rod or wire into the core to be irradiated for a predetermined period, and then withdraws the rod for counting the induced activity along the rod length. The apparatus has means for modifying the activity indication along the rod length in order to compensate for the non-uniformity of the irradiation period due to the lowering and withdrawal of the rod. The compensating means comprises a variable impedance or resistor, and a subtraction circuit between the amplifier and recorder. (D.L.C.)

ISOTOPE SEPARATION

8684 (PG-Report-386) THE PURIFICATION OF HYDROGEN ISOTOPES BY DISPLACEMENT GAS CHROMATOGRAPHY. T. R. Phillips and D. R. Owens (United Kingdom Atomic Energy Authority. Production Group, Capenhurst, Ches., England). 1962. 7p.

A method is described for the purification of hydrogen isotope mixtures by displacement gas chromatography. Columns packed with molecular sieve or alumina were effective for this purpose at low temperatures. Results are compared with those obtained with Pd columns. (J.R.D.)

8685 DISTRIBUTION OF Li ISOTOPES IN IMMISCIBLE SOLVENTS. V. M. Kolombirkin and N. I. Nikolaev. Zh. Fiz. Khim., 36: 2540-1(Nov. 1962). (In Russian)

Distribution coefficients of Li isotopes equilibrated between the lithium salts in aqueous solutions and Li salts in acetone, isoamyl, alcohol, diethyl ether, and amyl acetate were determined. Additions of a light petroleum fraction to lithium chloride solution in mixed methylamine and isoamyl alcohol in contact with aqueous solution of lithium chloride promote the movement of the light Li isotope to the opposite direction. (R.V.J.)

8686 DETECTION OF EXTRANEOUS MATERIAL DEPOSITIONS IN DIFFUSION PLANT EQUIPMENT. W. D. McCluen (Oak Ridge Gaseous Diffusion Plant, Tenn.). 4p. (TID-17461).

To be published in the Proceedings of the AEC-Contractors Meeting, held in Chicago, October 1962.

Survey techniques were developed to detect inadvertent accumulations of nuclear materials in diffusion equipment. Initial detection was based on gamma radiation from U^{235}. Subsequent quantitative evaluation relied on monitoring neutron radiation resulting from the collision between alpha particles and fluorine atoms. (auth)

8687 A GENERALIZED CASCADE FOR MULTICOMPONENT ISOTOPE SEPARATION. A. de la Garza, G. A. Garrett, R. L. Hoglund, E. Von Halle (Oak Ridge Gaseous Diffusion Plant, Tenn.). AIChE Preprint 118. New York, American Institute of Chemical Engineers, 1962. 28p. (TID-15753). $0.50.

The problem of designing a cascade for enrichment of an interior isotope in a multicomponent mixture is considered. The principle of the "matched abundance ratio cascade" is extended one step further. The resulting cascade, which mixes streams when the abundance ratio of two dummy components is matched, has been named the "M* cascade." The derivation of the pertinent equations for a 3-stream cascade with a single feed stream, one product stream, and one waste stream is presented. The features of the theoretical behavior of the cascade, the machine programming, and the computational scheme are discussed and illustrated by the problem of separating W^{184} from a mixture of five isotopic species. (A.G.W.)

8688 METHOD OF SEPARATING AND CONCENTRATING ISOTOPES AND DIFFICULT-TO-SEPARATE ELEMENTS BY ELECTROLYSIS. Ichiji Obinata. British Patent 913,336. Dec. 19, 1962. Priority date Feb. 6, 1960, Japan.

An ion exchange layer is placed in an electrolytic cell between the electrodes. A solution of the material to be separated is supplied to one of the electrodes; an acidic electrolyte is supplied to the other electrode. An alternating electric current or an ultrasonic wave is superposed on a direct current passed between the electrodes. The material to be separated is passed electrolytically through the ion exchange layer in back-and-forth movements. (R.J.S.)

8689 IMPROVEMENTS IN CELLS FOR SEPARATING ALKALI METAL ISOTOPES BY ELECTROMIGRATION. (to Compagnie de Saint-Gobain). French Patent 1,269,742. July 10, 1961.

The cell for separating alkali metal isotopes by countercurrent electromigration in a molten salt is provided with superheating zones, situated at the extremities of the diaphragm which communicates with the anode and cathode compartment. Thus the generation of gas bubbles within the diaphragm is prevented. (NPO)

8690 METHOD OF SEPARATING CHEMICAL BODIES OF DIFFERENT MOLECULAR MASSES. George Claude (to l'Air Liquide, Société Anonyme pour l'Etude et l'Exploitation des Procédés). French Patent 1,273,988. Sept. 11, 1961.

The patent relates to a diffusion process in which a solution containing salts of different molecular masses is atomized into an oblong flame with a laminar flow pattern, the flame being enveloped by a cold wall on which a part of the salts is redeposited. It is stated that the ratio of the components in the deposit differs from the ratio in the initial solution. The process may be applied for the separation of Li isotopes, the separation factor being 1.054 to 1.064. (NPO)

8691 SEPARATION OF BORON ISOTOPES. Karl Erik O. Holmberg (to Quartz and Silice S. A.). U. S. Patent 3,050,367. Aug. 21, 1962.

Boron-10 is separated from boron-11 by heating a liquid complex of boron trifluoride and anisole. A countercurrent flow of one of the dissociation products, gaseous boron trifluoride, with the liquid complex results in the concentration of boron-10 in the liquid complex and boron-11 in the boron trifluoride. (R.J.S.)

MATHEMATICS AND COMPUTERS

Refer also to abstract 8951.

8692 (AEEW-R-210) BINARY CODES WITH IMPULSE AUTOCORRELATION FUNCTIONS FOR DYNAMIC EXPERIMENTS. E. R. Corran and J. D. Cummins (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Sept. 1962. 15p.

A series of binary codes exist which have autocorrelation functions approximating to an impulse function. Signals whose behavior in time can be expressed by such codes have spectra which are 'whiter' over a limited bandwidth and for a finite time than signals from a white noise generator. These codes are used to determine system dynamic responses using the correlation technique. Programs were written to compute codes of arbitrary length and to compute 'cyclic' autocorrelation and cross-correlation functions. Complete listings of these programs are given, and a code of 1019 bits is presented. (auth)

8693 (ANL-6641) APPLIED MATHEMATICS DIVISION SUMMARY REPORT, JULY 1, 1961–JUNE 30, 1962. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 67p.

A summary of each computer program initiated during the report period is given. Over 130 programs are described briefly. Work is also being carried out on the completion of the GEORGE-FLIP Computer system and the development of retrieval and pattern recognition systems. (M.C.G.)

8694 (BNL-760) RANDOM MATRIX DIAGONALIZATION—A COMPUTER PROGRAM. K. Fuchel, Rita J. Greibach, and C. E. Porter (Brookhaven National Lab., Upton, N. Y.). Sept. 1962. Contract [AT(30-2)-Gen-16]. 80p.

A computer program is described which generates random matrices, diagonalizes them and sorts appropriately the resulting eigenvalues and eigenvector components. FAP and FORTRAN listings for the IBM 7090 computer are included. (auth)

8695 (CDRP-182-108) AN IBM 704 COMPUTER PROGRAM FOR CALCULATING THE EQUIVALENT RESIDUAL DOSE IN COMPLEX OPERATIONAL SITUATIONS. Lawrence F. Wagner (California. Univ., Berkeley. Inst. of Engineering Research). Oct. 30, 1962. Contract CD-SR-58-40. 15p.

The equivalent residual dose concept permits a more reliable prediction of the biological and medical consequences of exposure to radiation than is possible on the basis of the accumulated dose alone. The development of recursive equations simplifies the calculation of the equivalent residual dose in complex operational situations. A computer program for these calculations is presented. (auth)

8696 (HW-SA-2304) STUDIES IN RELIABILITY. I. THE ALGEBRA OF FOUR-STATE SAFETY DEVICES. A. D. Wiggins (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 13, 1961. Contract AT(45-1)-1350. 11p.

It is noted that in the design of reactor safety systems modes of equipment failure such as those in which a component fails to perform its intended function or those in which the component either performs a function for which it is not intended or performs the function for which it is intended at the wrong time must be considered. A mathematical analytic procedure for evaluating variables associated with reactor systems and predicting reliability of such systems is presented. (J.R.D.)

8697 (HW-SA-2388) IMPROVING COMPUTER PROGRAM-TESTING SERVICE. Edward C. Arbuckle and Emil J. Saxberg (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 11, 1962. Contract [AT(45-1)-1350].

Results of studies concerning the level of computer program-testing (debugging) service at Hanford are presented. It was found that with improved planning, clarification of operating policy, increased peripheral operations capacity, and revised work methods, the amount of time required for debugging programs can be drastically reduced. An IBM 7090 computer is operated at Hanford in association with peripheral equipment including two IBM 1401 systems. Results of the study are discussed, and development of a revised operating policy is described. (J.R.D.)

8698 (LADC-5548) STRETCH MASTER CONTROL PROGRAM. J. L. Garrity, G. R. Hira, J. F. O'Connell (International Business Machines Corp., Poughkeepsie, N. Y.) and C. A. Folkner (Los Alamos Scientific Lab., N. Mex.). [1962]. Contract [W-7405-eng-36]. 31p.

The IBM 7070 STRETCH machine requires, by its speed and design, some resident routine, monitor, or interruption handler. The STRETCH Master Control Program (MCP) is described along with how it evolved, and how well it achieved its original objectives. MCP goes further than the basic requirements; it tries to provide tools for expansion in language systems and to provide checks for both the programmer and the machine. Also, it furnishes efficient operator-to-machine communication and preassignment of tapes. The STRETCH Master Control Program also tries to create an environment that is satisfactory to both machine and automatic programming. (auth)

8699 (NP-12396) A "MINIMUM SYSTEMATIC VARIANCE" METHOD FOR EVALUATING THE MOST PROBABLE VALUES OF TWO PARAMETERS. Eurochemic Technical Report No. 114. T. Erben (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium). July 31, 1961. 8p.

A general method is described for determining two unknown parameters simultaneously. This method is based on the properties of a quantity named "systematic variance" defined as the variance of a set of "artificial" values of one of the parameters, calculated by assigning an arbitrary value to the other parameter. The minimum value of the systematic variance equals the conventional statistical variance. This arises when the arbitrary value happens to equal the true value of the parameter, whereby making the evaluation possible. This technique was applied successfully in two different cases encountered in Eurochemic studies. In one case, it was necessary to determine the optical density at complete conversion along with the rate constant in a slow reaction. In the second instance, the problem was the evaluation of the maximum plutonium loading in a resin column by using non-equilibrium data to be correlated by means of the Boyd-Adamson equation. (auth)

8700 (NYO-9192) ON THE GENERALIZED OVER-RELAXATION METHOD FOR OPERATOR EQUATIONS.

W. V. Petryshyn (New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center and New York Univ., New York. Courant Inst. of Mathematical Sciences). June 14, 1962. Contract [AT(30-1)-1480]. 20p.

The necessary and sufficient conditions for the spectrum of the generalized overrelaxation operator $T(\omega) = (D + \omega S)^{-1} \{(\omega-1)D + \omega Q\}$ to lie in the interior of the unit circle centered at the origin are derived. (auth)

8701 (NYO-9760) A FINITE DIFFERENCE SCHEME FOR THE NEUMANN AND THE DIRICHLET PROBLEM. K. O. Friedrichs (New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center). Aug. 8, 1962. Contract AT(30-1)-1480. 43p.

A specific feature of the finite difference scheme proposed is that in it the boundary condition and the differential equation are treated simultaneously. The scheme results from a variational principle of the original differential equation problem, simply by using the Ritz method employing piecewise linear approximation functions. Thus a rather uniform treatment of boundary condition and differential equation will result. The coefficients of the substitute boundary condition will be given as the areas of sections of triangles cut out by the boundary; they are therefore not sensitive to variations of the direction of the boundary. An advantage of the approach is that the mean convergence of the solutions of the difference equations (including first difference quotients) to that of the differential equation is implied by the general theory and requires no special proof. Whether or not the scheme is useful in actual computation is still to be seen. The scheme for the Neumann problem of Laplace's equation is first described; then its extension to systems of second order is discussed. A lower estimate is given for the eigenvalues of the matrix involved. The method for extending the scheme to the Dirichlet problem is indicated. (auth)

8702 (TID-16821) A STUDY OF ARITHMETIC RECODING WITH APPLICATIONS IN MULTIPLICATION AND DIVISION (thesis). Report No. 128. J. O. Penhollow (Illinois. Univ., Urbana. Digital Computer Lab.). Sept. 10, 1962. Contract AT(11-1)-415. 170p.

A study was made of recoding functions in general and minimal recoding functions in particular as applied to multiplication and division. A mathematical formulation was developed for study of a certain class of arithmetic recodings as applied to positive integral radix representations. Left and right directed recodings of a binary radix complement representation were investigated. Sets of recoding functions which transfer a binary representation into an extended signed-digit representation having a minimum of nonzero digits were investigated. Both left and right directed sets of minimal recoding functions were considered. Applications were made of minimal recoding to multiplication and division algorithms. It was found that, in the binary case, the characteristics of a minimal representation are governed by a set of Boolean mode functions. (M.C.G.)

8703 (TID-17654) NUMERICAL INTEGRATION AND DIFFERENTIATION OF FUNCTIONS OF SEVERAL INDEPENDENT VARIABLES BY AN ITERATIVE PROCEDURE. Henry C. Thacher, Jr. (Argonne National Lab., Ill.). Oct. 1962. Contract [W-31-109-eng-38]. 15p. (UAC-6924)

Aitken's iterative interpolation scheme is extended to give an iterative procedure for integrals and partial derivatives of the multivariate interpolation polynomial of degree n defined by function values at a suitable set of points. The two-dimensional case for up to fourth-degree interpolation polynomials was programed for the LGP-30 computer, and typical results are tabulated. Errors are discussed. (D.L.C.)

8704 (WAPD-R(WB)-1) DIGITAL COMPUTER PROGRAMS FOR THE STATISTICAL ANALYSIS OF DATA. T. Shimamoto (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1962. Contract AT(11-1)-Gen-14. 15p.

Three computer programs for the statistical analysis of data in the BOSS language for the Philco-200 are described. They are: 00153 for the analysis of nested classification, 00163 for the analysis of extreme value data, and 00193 for the analysis of factorial designs. (M.C.G.)

8705 RECURSIVE METHODS, DYNAMIC PROGRAMMING, AND INVARIANT IMBEDDING. Arthur Wouk (Sylvania Electronic Systems, Waltham, Mass.). SIAM (Soc. Ind. Appl. Math.) Rev., 4: 384-93(Oct. 1962).

The recursion-like mathematical method of dynamic programming, which uses the so-called "Principle of Optimality," is outlined, and the invariant imbedding techniques used in conjunction with this method are discussed. The method is applied to a multinomial problem, a neutron transport model, and problems in the calculus of variations. (T.F.H.)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

8706 (HW-73698(Rev.)) POSTIRRADIATION EVALUATION OF ZIRCALOY-2 PRTR PRESSURE TUBES. PART I. L. J. Defferding (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 1962. Contract AT(45-1)-1350. 37p.

Three tubes were removed from the PRTR for detailed postirradiation tests and inspections. The room temperature burst properties, depth of fretting corrosion, changes in grain structure, and the extent of crevice corrosion were determined. The observations may be summarized as follows: (1.) Irradiation to 10^{20} nvt (E > 1 Mev) produced a small increase in room temperature burst strength and a decrease in ductility. The uniform deformation of the specimen prior to the local bulging that precedes failure decreased to a negligible amount at the highest exposure. One tube failed when a short crack propagated through the wall at a stress equivalent to about 85% of ultimate burst stress. The crack did not then propagate the length of the specimen under these severe circumstances which indicates that the material is still behaving in a ductile manner at room temperature. (2.) Close-up visual examination revealed that the fretting corrosion marks appeared much the same as in photos taken through the borescope. Depths of penetration from standard fuel element end brackets were found up to 6 mils deep. Outer wire wraps and, occasionally, individual rod wire wraps caused similar penetrations of the tube wall. Bands on Pu–Al elements did not cause any measurable penetration of the tube wall. Increasing the width of contact area of the fuel end bracket apparently decreased the penetration. (3.) The grain structure under the fretting corrosion marks was unchanged in many instances; however, local hydriding was found in a thin layer under three of the twelve corrosion defects that were examined. Visual appearance of the corrosion mark gave no indication of the presence of hydride. (4.) Crevice corrosion of the upper flange penetrated up to 4 mils. Heavy white corrosion product is present but little if any local hydriding has occurred since the first operating period. From the above observations it is concluded that even though the continued penetration of the tube wall by fretting corrosion would be detrimental to the integrity of the pressure tubes, the general behavior of the tubes to date has been superior to that anticipated when the tubes were designed. (auth)

8707 (MRC-341) IRON SINGLE CRYSTAL PREPARATION. Quarterly Letter Report No. 2, July 1, 1962–October 1, 1962. R. T. Brenna, C. F. Malo, Jr., E. J. Hughes, and G. Abowitz (Materials Research Corp., Orangeburg, N. Y.). Oct. 29, 1962. Contract AT(30-1)-2980. 21p.

The growth of high-purity iron single crystals has been continued and considerable effort has been devoted to the study of the effect of the various processing parameters on the growth of large single crystals. The variables that have been investigated are the mode and amount of cold work, annealing temperature, prestrain, grain size, i.e., the recrystallized grain size, amount of strain, and the surface condition of the specimen. These variables have been optimized to yield a reproducible strain-anneal program capable of producing single crystals of electron beam floating zone refined iron. (auth)

8708 (NMI-2110) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report to United States Atomic Energy Commission, September 1962. (Nuclear Metals, Inc., Concord, Mass.). Nov. 26, 1962. Contract AT(30-1)-2784. 10p.

Progress is reported on the fundamentals of single-crystal deformation in zone-refined beryllium, the high-temperature properties of refractory metal alloys, the development of uranium-base alloys strengthened by SiIs techniques, and extruded tungsten tubing. (W.D.M.)

8709 (NP-12487) REPORT ON SODIUM COMPATIBILITY OF GRAPHITES AND SEMI-GRAPHITES. L. R. Kovac (Atomic Power Development Associates, Inc., Detroit). July 27, 1962. 15p.

Tests were made to measure the total sodium absorption and volume expansion of several types of graphites and semigraphites immersed in liquid Na at 500, 700, and 900°F in restrained and unrestrained conditions for periods up to 336 hr. The results show that the total Na absorption volume is approximately equal to the sum of swelling and void volumes, except for anomalies at 700°F. The rate of Na absorption and swelling was found to be rapid, the absorption being complete within the first 24 hr. The total amounts of Na absorption and swelling increase with temperature and are greater for the semigraphites than for the graphites. It is concluded that the graphite shield design should have provision for 5% volume increase in the event of a catastrophic sodium leak into the shield tank. (D.L.C.)

8710 (TID-16315(Del.)) ADVANCED NUCLEAR ROCKET MATERIALS RESEARCH. (Division of Reactor Development, AEC). May 31, 1962. 6p.

A number of metals, carbides, nitrides, oxides, borides, and uranium sulfides are briefly evaluated concerning their possible applications as advanced nuclear rocket materials. (R.J.S.)

8711 (TID-17556) ANNUAL REPORT [ON] SOLID STATE SCIENCE. (Franklin Inst. Labs. for Research and Development, Philadelphia). Dec. 20, 1962. Contract AT(30-1)-2994. 93p.

Research progress is reported on basic mechanisms of radiation damage, x-ray effects caused by defects in metals, surface diffusion, and x-ray study of the structure of small particles. (M.C.G.)

8712 (TID-17593) GRAPHITE-MATRIX NUCLEAR FUEL ELEMENTS. Summary Report, Phase III. (National Carbon Co. Product and Process Development Lab., Fostoria, Ohio and National Carbon Co. Research Labs., Parma, Ohio). Dec. 21, 1962. Contract AT(40-1)-2560. 129p.

Information is presented on the third and final phase of an investigation of the fabrication, chemical and physical properties, and irradiation behavior of graphite-matrix fuel elements. Results of studies concerning various techniques for blending fuel with the components of a carbonaceous mix, with particular emphasis on the use of fuel particles up to 400 micron diameter, for both molded and extruded fuel elements are included. Other studies are reported on migration of U in graphite-matrix fuel elements at temperatures and with radial thermal gradients such as might be encountered in reactor applications, on the physical properties of extruded graphite-mixture fuel elements, and on analysis of data from a series of irradiation experi-

ments, carried out in cooperation with Oak Ridge National Laboratory. (auth)

8713 (CEA-tr-R-1556) RAFFINAGE DU BERYLLIUM PAR DISTILLATION SOUS VIDE. (Refining of Beryllium by Distillation Under Vacuum). V. E. Ivanov, V. M. Amonenko, G. F. Tikinskii (Tikinsky), and A. A. Kruglykh (Kroughlih). Translated into French by N. Sacovy from Fiz. Metal. i Metalloved., 10: 581-5(1960). 11p.

A method for the production of high purity metals by distillation under vacuum with condensation on a heated surface is described. The possibility of eliminating impurities that have a vapor pressure close to that of the metal refined is shown. The optimum conditions for the production of high purity Be (99.987% without consideration of oxygen) were defined. The reasons for the presence of carbon and oxygen in the distilled Be are discussed. The microhardness of the distilled Be is 130 kg/mm^2. (tr-auth)

8714 (CEA-tr-X-475) MOYENS DE DÉCOMPOSER LE BÉRYLLIUM. (Means of Decomposing Beryllium). Karel Vetejska and Jan Mazacek. Translated into French from Czech Patent No. 96,110. [1959]. 7p.

A method for the decomposition of beryl is described. According to this method, powdered beryl is mixed with calcium hydroxide in proportion of 1:5 by weight and heated for two hours at temperatures from 950 to 1000°C. With this proportion 99.5% of the beryl is decomposed. (J.S.R.)

8715 (EURAEC-451) RESEARCH INTO ZIRCONIUM HYDRIDE IN ZIRCALOY-2 AND ZrNb ALLOYS. Quarterly Report No. 4, July 1 to September 30, 1962. (Siemens-Schuckertwerke A. G., Erlangen, Germany). Work Performed under United States–Euratom Joint Research and Development Program. Contract 024-61-10-RDA. 22p. A translation.

Results are given on corrosion tests of Zircaloy-2 and Nb–Zr alloys in superheated steam. Hydrogen absorption by Zircaloy-2 and Nb–Zr alloys in superheated steam is reported as well as the embrittlement produced by the absorption. (R.J.S.)

8716 (EURAEC-498) WORKING PROCEDURE FOR THE MANUFACTURE OF PRESSURE VESSELS. Quarterly Report No. 3, July 1–September 30, 1962. (Neratoom, N. V., The Hague). Oct. 16, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 069-61-12-RDN. 17p. A translation.

Nine 200-mm thick steel plates were received, and the mechanical properties are plotted. Ultrasonic tests were made on four 300-mm thick plates and found satisfactory. Notched bar impact tests were made on welded seams, and welding tests are being made. (D.L.C.)

8717 MATERIALS OF CONSTRUCTION FOR THE DUAL TEMPERATURE EXCHANGE PROCESS FOR PRODUCING HEAVY WATER. Victor R. Thayer and W. B. DeLong. Chem. Eng. Progr., Symp. Ser., 58: 86-93(1962).

The development program on construction materials for the GS process is described. Data are given for the corrosion of austenitic stainless steel, carbon steel, type 410 stainless steel, and steel by aqueous H_2S. As a result of the program, carbon steel is used for a large part of the equipment in the heavy water plants, because it is protected from corrosion by a coating of iron sulfide. Bubble cap trays are made of stainless steel, since the impinging spray results in rapid corrosion of carbon steel. Carbon steel, low-alloy steel, and stainless steel are heat-treated to relieve stress due to fabrication; if this is not done, failure may occur owing to hydrogen embrittlement or stress corrosion cracking. Bolts are also heat-treated to reduce hardness below a critical maximum value and are installed to a predetermined stress level. The use of organic amines and other nitrogen compounds to inhibit the corrosion of carbon steel was found impracticable because the formed iron sulfide does not adhere to the steel and forms a troublesome sludge. (D.L.C.)

8718 EFFECT OF AMMONIUM DIURANATE PRECIPITATION CONDITIONS ON THE CHARACTERISTICS AND SINTERING BEHAVIOUR OF URANIUM DIOXIDE. J. B. Ainscough and B. W. Oldfield (United Kingdom Atomic Energy Authority, Springfields, Lancs, Eng.). J. Appl. Chem. (London), 12: 418-24(Sept. 1962).

Ammonium diuranate was prepared by adding aqueous ammonia to uranyl nitrate solution under different conditions of temperature and final pH. The resulting precipitates, when dried, can be considered as loosely bound compounds with an ammonia/uranium ratio of 0:37 containing varying amounts of water and ammonium nitrate. As well as differing in composition, these precipitates differ markedly in their specific surface areas. After calcination to U_3O_8 in argon at 700° and reduction in hydrogen at the same temperature, all the diuranates yield uranium dioxide of similar specific surface, and it is concluded that the calcination temperature is the principal factor in determining this. The powders, when milled, mixed with an organic binding agent, granulated, pressed, and sintered in hydrogen for 2 hr at 1650°, give uranium dioxide compacts with bulk densities greater than 96.5% of the x-ray density (10.96 g/cm^3). Little, if any, correlation was found between the precipitation conditions and the sintered densities of the compacts, although a relatively rapid rate of addition of ammonia seems to give a slightly denser compact and it seems possible that some uncontrolled variation during milling or pressing outweighs any effects due to differences between the powders. (auth)

8719 USE OF INDUCTION HEATING FOR FLOATING ZONE MELTING ABOVE 2000°C. Robert W. Johnson (Ames Lab., Ames, Iowa). J. Appl. Phys., 34: 352-5(Feb. 1963). (IS-471)

The method described uses an eddy current concentrator to focus the energy of an r-f magnetic field on a small part of a ¼-in.-dia. rod. Zone melting has been carried out at temperatures above 2600°C, and can probably be extended to temperatures above 3000°C. The advantages of this method over some others used in the same temperature range are that it can be carried out under an inert gas atmosphere instead of a vacuum, and uses for its power supply conventional 450-kc induction heating equipment. (auth)

8720 THERMAL RESTORATION OF THE LATTICE PARAMETER OF WEAKLY IRRADIATED UO_2. J. Bloch (Centre d'Etudes Nucleaires, Saclay, France). J. Nuclear Mater., 3: 237-8(1961). (CEA 2137)

Weak irradiations of uranium dioxide lead to an expansion of the crystal lattice. The restoration of the lattice parameter after successive isochronic annealings was studied. The process occurs in two main stages, one starting at 200°C and the other at 500°C. (auth)

8721 ANTIRADIATION BUILDING MATERIALS. Tan-shen Shen. K'o Hsueh Ta Chung, No. 4, 123-4(1962).

Since lead plates are good but expensive antiradiation building material, a kind of concrete mixed with heavy spar, brown iron ore, or magnetic iron ore can be used to replace lead plates. Lead glass can absorb gamma rays while glass containing lithium, beryllium, or cadmium has an antineutron characteristic. Plastic materials containing lead powder also have anti-gamma ray characteristics. (OTS)

8722 THE EFFECTS OF LANTHANUM AND CERIUM IN THE REFINING OF IRON. STUDY OF THE REACTIONS WITH OXYGEN, SULPHUR AND CARBON IN SOLUTION (CONCLUDED). Jacques Richerd. Mem. Sci. Rev. Met., 59: 597-615(Sept. 1962). (In French)

The results obtained in the study of the rare earth-metalloid reactions are given. The nature of the compounds obtained is shown experimentally and verified by calculation. The order of the reaction between one of the rare earths and oxygen, sulfur, or carbon shows that the monosulfides can be produced only after the sesquioxides. The rare earth can act as decarburizer only if it is present in excess. Finally, emphasis is laid on the unfavorable effect of the crucible, which releases oxygen and is largely responsible for the observed loss in rare earths. (auth)

8723 STUDY ON THE PREPARATION OF URANIUM CARBIDES. Ken Sato (Nippon Light Metal Research Lab., Japan), Keiji Naito, and Takashi Mukaibo. Nippon Genshiryoku Gakkaishi, 4: 754-8(Nov. 1962). (In English)

Single-phase uranium monocarbide was prepared by the solid-solid reaction between uranium hydride and carbon above 900°C. The activation energy of the reaction is estimated to be in the range of 15 to 45 kcal/mol, and the rate is supposed to depend upon the diffusion of carbon rather than that of uranium. Uranium sesquicarbide was also prepared by the solid-solid reaction between uranium monocarbide and carbon at 1,500 to 1,700°C without any stress. Uranium dicarbide appears above 1,200 to 1,300°C in the reaction between uranium monocarbide and carbon, but temperatures higher than 1,800°C were found to be necessary to prepare it in a single phase. (auth)

8724 RADIATION AND MOISTURE EFFECTS IN POLYMERIZED EPOXY RESINS. D. E. Kline and J. A. Sauer (Pennsylvania State Univ., University Park). SPE (Soc. Plastics Engrs.) Trans., 2: 1-4(Jan. 1962).

Dynamic mechanical tests were performed on specimens prepared from bisphenol A-based epoxy and cured with m-phenylenediamine. The effects of moisture and radiation on the dynamic modulus and mechanical damping of the resins were studied. (D.L.C.)

8725 RHENIUM. Papers Presented at the Symposium on Rhenium of the Electrothermics and Metallurgy Division of the Electrochemical Society, May 3 and 4, 1960, Chicago, Illinois. B. W. Gonser, ed. Amsterdam and New York, Elsevier Publishing Company, 1962. 233p. $11.00.

Twenty-three papers are presented on the extractive metallurgy, properties, physical metallurgy, fabrication, applications, and analytical chemistry of rhenium and its alloys. Separate abstracts were prepared for four papers dealing with rhenium alloys. (D.L.C.)

8726 SOME PHYSICAL PROPERTIES OF RHENIUM AND ITS ALLOYS. E. M. Savitskii and M. A. Tylkina (Metallurgical Inst., Moscow). p.57-66 of "Rhenium." Amsterdam and New York, Elsevier Publishing Company, 1962.

Studies were made of the recrystallization of rhenium, and of alloying with tungsten, nickel (in Ni–Cr alloys), and with titanium and its alloys. Rhenium additions improve both the room and elevated temperature properties and increase the initial recrystallization temperatures. Solid solution tungsten alloys have increased workability and electrical resistance. Applications for rhenium alloys are promising for thermo-couples, electrical contacts, and some vacuum tube parts. Results are given of a study of rhenium as a contact material. (auth)

8727 PHASE DIAGRAMS OF RHENIUM WITH TRANSITION METALS. E. M. Savitskii and M. A. Tylkina (Metallurgical Inst., Moscow). p.67-83 of "Rhenium." Amsterdam and New York, Elsevier Publishing Company, 1962.

Binary phase diagrams of rhenium with titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, manganese, and cobalt were determined. A number of these alloy systems are characterized by the formation of intermetallic phases of the sigma or alpha-manganese types. Comparisons are made of these and other common features of the respective diagrams on the basis of the periodicity of the binary alloy additions. (auth)

8728 POWDER METALLURGY OF REFRACTORY ALLOYS CONTAINING RHENIUM. Marie-Louise Jungfleisch and Jean J. Fabry (Etablissements Ch. Bertolus, Bellegarde, France and Societe Bocuze, Lyons). p.111-13 of "Rhenium." Amsterdam and New York, Elsevier Publishing Company, 1962.

Information on the fabrication of refractory alloys containing rhenium is presented. This includes the determination of some of the characteristics of metal powders giving the best results, particularly the importance of average particle diameter, as well as blending, pressing, sintering, swaging, and the drawing of fine wires (down to 0.001 in.). A study has been started to develop the applications of these alloys in the fields where their unique properties are the most valuable. (auth)

8729 THE WORKABILITY AND MECHANICAL PROPERTIES OF TUNGSTEN- AND MOLYBDENUM-BASE ALLOYS CONTAINING RHENIUM. D. J. Maykuth, F. C. Holden, and R. I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). p.114-25 of "Rhenium." Amsterdam and New York, Elsevier Publishing Company, 1962.

Procedures for the fabrication of arc melted tungsten- and molybdenum-base alloys, containing 22 to 35 at.% rhenium, to strip, rod, and wire were developed. Data are given on the recrystallization behavior and the effects of temperature on the tensile and bend properties of these alloys. The mechanism by which rhenium improves the ductility of tungsten and molybdenum is discussed. (auth)

8730 RUTHENIUM. New York, The International Nickel Company, Inc., [1962]. 16p.

A pamphlet is presented which summarizes data relating to ruthenium. The properties of the metal ruthenium are described, and the following forms of ruthenium are discussed: coatings, alloys, compounds, and catalysts. A bibliography of 55 references is included. (D.L.C.)

8731 CRYOGENICS AS APPLIED TO THE DESIGN AND FABRICATION OF A SPACE SIMULATION TEST CELL AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER. S. P. Ansley, Jr. Preprint 595A. New York, Society of Automotive Engineers, Inc., 1962. 10p. $1.00.

Paper from National Aerospace Engineering and Manufacturing Meeting, Los Angeles, Oct. 8-12, 1962.

The unusual features of the Ultrahigh Altitude Rocket Cell J-2A are described with emphasis on the cryogenic systems for cooling the diffuser and chamber liner to liquid-nitrogen temperature and the helium-refrigerated cryopumping surfaces to 20°K. It is concluded that space simulation testing of large rocket engines under actual firing conditions is possible. (auth)

8732 METHOD FOR MAKING ZIRCONIUM BORIDE. (to Carborundum Co.). British Patent 911,062. Nov. 21, 1962. Priority date Mar. 21, 1960, United States.

A process is outlined for producing ZrB_2 in one step from zircon at a cost approximately ⅓ of that of previous processes. The process comprises reacting a mixture of

zircon, boric oxide, and carbon at arc furnace temperatures (≥1750°C). The preferred mixture proportions are 40 to 60% zircon, 15 to 35% boric oxide, and carbon 15 to 25%. The resulting boride contains a small amount of hafnium boride. An arc furnace is described for carrying out the process. (D.L.C.)

8733 PLUTONIUM ALLOYS CONTAINING CONTROLLED AMOUNTS OF PLUTONIUM ALLOTROPES OBTAINED BY APPLICATION OF HIGH PRESSURES. (to U. S. Atomic Energy Commission). British Patent 912,282. Dec. 5, 1962. Priority date June 2, 1959, United States.

A method is given for treating delta-stabilized Pu alloys to eliminate voids and cracks and to effect partial transformation to the alpha and/or beta allotropes. The method comprises compressing the alloys to effect the transformation, and the properties of the treated alloys are intermediate between these for the alpha and beta phases. Data are given for carrying out the method with binary Pu alloys of Al, Zn, In, Ce, Zr, Hf, and Er. (D.L.C.)

8734 IMPROVEMENTS IN OR RELATING TO SUSPENSIONS OF BERYLLIA. Ivor James Holland (to United Kingdom Atomic Energy Authority). British Patent 914,895. Jan. 9, 1963. Filed Sept. 9, 1960.

A beryllia suspension is produced by calcining beryllium hydroxide at a temperature between 1650 and 1700°C. A second beryllia suspension is produced by calcining beryllium hydroxide at a temperature between 950 and 1200°C. The suspensions are suitable for the slip-casting of thin-walled beryllia bodies. (R.J.S.)

8735 IMPROVEMENTS IN AND RELATING TO THE PRODUCTION OF CARBON BODIES OF LOW PERMEABILITY. Donald Arthur Boyland (to General Electric Co. Ltd.). British Patent 915,062. Jan. 9, 1963. Filed Aug. 15, 1960.

A process is described for the production of a corrosion-resistant carbon body. A carbon body, which is resistant to corrosion, is subjected a number of times to sugar impregnation and carbonization steps in order to reduce the gas permeability of the body. (R.J.S.)

8736 METHOD OF PREPARING NUCLEAR FUEL. (to Wissenschaftlich-Technisches Büro für Reaktorbau). French Patent of Addition No. 75,699 (Addition to French Patent 1,225,153, NSA 16-15812). June 19, 1961.

The patent relates to the preparation of a liquid metal fuel, consisting of a metal carrier (Pb, Bi, or their alloys with Zn, Li, Na, and/or K) in which fuel particles are suspended. Molecular H_2 is dissociated by means of a high-frequency electric arc; the atomic H thus formed is introduced into the fused carrier metal on the surface of which the fuel particles are made to float. The H deoxidizes the particles as well as the carrier metal, resulting in the wetting and dispersing of the particles. (NPO)

8737 METHOD FOR THE DIRECT PREPARATION OF GRANULAR MATERIAL CONTAINING URANIUM WITH A DETERMINATE PARTICLE SIZE AND A CLEARLY SPHERICAL SHAPE. (to Stichting Reactor Centrum Nederland). French Patent 1,271,794. Aug. 7, 1961.

The patent relates to the preparation of granular fuel material, particularly UO_2, which can be applied in a reactor with a circulating aqueous fuel suspension (see French patent No. 1,105,731). Solid NH_4NO_3 is added to a uranyl salt solution and then so much aqueous NH_3 that no precipitate is produced. Precipitation is effected by the addition of solid $(NH_4)_2SO_4$, the pH being kept above a critical value of 2 to 3. The precipitate is preheated at 150°C, converted with aqueous NH_3, and finally reduced with H_2. The final product consists of spherical UO_2 particles, having a size of 4 to 7 micron. (NPO)

8738 PRODUCTION OF HAFNIUM METAL. Gerald W. Elger and Richard W. Boubel (to U. S. Atomic Energy Commission). U. S. Patent 3,071,459. Jan. 1, 1963.

This patent deals with a process of producing pure Hf metal from oxygen-contaminated gaseous Hf chloride. The oxygen compounds in the chloride gas are halogenated by contacting the gas at elevated temperature with Cl_2 in the presence of C. The Hf chloride, still in gaseous form, is contacted with molten Mg whereby Hf metal is formed and condensed on the Mg. (AEC)

Corrosion

Refer also to abstract 10074.

8739 (AD-277355) IMPROVED OXIDATION RESISTANCE OF MOLYBDENUM BY ALLOYING WITH RARE EARTH AND OTHER SELECTED METALS. Interim Report No. 3, March 1, 1962–April 30, 1962. (Colorado School of Mines Research Foundation, Inc., Golden). May 29, 1962. Contract NOw-62-0305-d. 11p.

Selective oxidation experiments were carried out at temperatures ranging from 1000 to 1540°C on binary Mo alloys containing 0.026 at.% Y and 0.056 at.% Hf, respectively, with the object of forming protective coatings of Y_2O_3 and HfO_2. The Y and Hf were selectively oxidized in an H atmosphere. The oxidation rates were parabolic and were achieved by a mechanism of internal oxidation in all experiments performed. This mechanism indicated that the oxygen flux into the alloy exceeded the outward flux of the alloying element to the alloy-air interface. To achieve a protective coating on the alloy surface, these rates of flux should be equal. The parabolic rate constants obtained and estimated diffusion coefficients indicated that the outward flux of Y and of Hf should have been sufficient to achieve a protective outer coating. These results show that higher alloying contents of Y and Hf, or higher temperatures may well yield the results sought. (auth)

8740 (BMI-X-213) CORROSION RESISTANCE OF EXPERIMENTAL NICKEL-BASE ALLOYS UNDER HYDROFLUORINATOR CONDITIONS. P. D. Miller, E. F. Stephan, W. N. Stiegelmeyer, and F. W. Fink (Battelle Memorial Inst., Columbus, Ohio). Dec. 5, 1962. Contract [W-7405-eng-92]. 23p.

Corrosion results from the experimental alloys have not provided any clearly defined compositional trends which could lead to improved alloy compositions. Corrosion results from the recent runs, along with results for INOR-8 from previous studies, have been summarized. In general, INOR-8 and HyMu-80 are quite similar in their resistance to corrosion in the HF system. In some instances, INOR-8 was superior to HyMu-80; in other runs, the reverse was true. Accordingly, it is recommended that INOR-8 and HyMu-80 be evaluated individually for use in a single vessel process. Preliminary studies could be made by constructing a hydrofluorinator-fluorinator from the material of interest and subjecting it to alternate sparges of HF and F_2 under conditions simulating plant practice. The container itself would serve as the corrosion specimen and would be carefully examined at the conclusion of the cyclic operation. The importance of salt-bath composition on corrosion results is pointed out. The compositions containing $NaF-LiF-BeF_2$ are much more corrosive than any others. It is believed that the corrosion may be related to the solubility of HF in the salt. It has been shown

that the solubility of HF in $NaF-ZrF_4$ melts increases with increasing NaF content. In general, corrosion parallels this behavior. The corrosion is probably related to the solubility of the metal fluorides in the molten salt. For example, it is known that the solubility of NiF_2 is much greater in $NaF-LiF-BeF_2$ than in $NaF-ZrF_4$. (R.J.S.)

8741 (DP-788) CONTAMINATION AND DECONTAMINATION OF LOW TEMPERATURE, WATER-COOLED REACTORS. PART II. DEPOSITION OF RADIONUCLIDES ON ALUMINUM FROM SOLUTIONS. Anton B. Carlson (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Oct. 1962. Contract AT(07-2)-1. 17p.

The deposition from aqueous buffer systems of dissolved Co^{60}, Cr^{51}, Fe^{59}, $Ru^{106}-Rh^{106}$, and $Zr^{95}-Nb^{95}$ on aluminum surfaces was investigated at 25°C. It is shown that the direct deposition of dissolved radionuclides in the oxide lattice is an important mechanism by which aluminum fuel assemblies become contaminated. Deposition is a minimum where the corrosion rate of aluminum is a minimum. (auth)

8742 (EURAEC-448) MICROGRAVIMETRIC INVESTIGATION INTO THE MECHANISMS OF CORROSION OF REACTOR MATERIALS IN THE PRESENCE OF NUCLEAR MATERIALS. Quarterly Report No. 3, July 1 to September 30, 1962. (Battelle Institut e. V., Frankfurt am Main). Work Performed under United States–Euratom Joint Research and Development Program. Contract 071-61-12-RDD. 16p.

Preliminary corrosion experiments were carried out on 99.999% purity iron powder, carbonyl iron powder, and 99.999% purity iron foils 6 microns thick. The corrosion kinetics are not strongly affected by the shape of the material. After oxidation at 200°C in oxygen and subsequent reduction in hydrogen, the specific surface area of the iron foils increased by a factor of ~2.5. After oxidation at 100°C, the surface area increase was negligible. At 100°C, corrosion ceased after ~10 minutes with iron foils in water vapor as well as in pure oxygen. The limiting weight gain per unit projected surface area was 0.55 $\mu g/cm^2$ in water vapor and 0.90 $\mu g/cm^2$ in oxygen. At 200°C, corrosion of iron foils proceeded in water vapor and oxygen even after two hours. (D.L.C.)

8743 (NASA-TN-D-1442) COMPATIBILITY OF MOLTEN URANIUM DIOXIDE WITH FIVE REFRACTORY MATERIALS. William A. Sanders and Isadore L. Drell (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Jan. 1963. 32p.

The compatibility of molten uranium dioxide with tungsten, tantalum, tantalum diboride, tantalum carbide, and hafnium carbide was determined at 5220°F for a test period of 15 minutes in a static argon atmosphere. Reactions occurred in all cases; however, the use of tungsten, tantalum, or hafnium carbide in contact with molten uranium dioxide appears possible for short time applications. (auth)

8744 (TID-17585) THE ELECTROCHEMICAL AND CORROSION CHARACTERISTICS OF RARE EARTH AND YTTRIUM METALS. Annual Report. (Rensselaer Polytechnic Inst., Troy, N. Y.). Dec. 1962. Contract AT(30-1)-2714. 13p.

Results and conclusions are summarized for the following areas of research: the corrosion behavior of the rare earth metals, the electrochemical characteristics of the rare earths, and the dissolution of U and Th and their alloys. (R.J.S.)

8745 (EURAEC-379) STUDY OF SOME METAL OXIDATION PROBLEMS AND APPLICATIONS OF IMPEDANCE MEASUREMENT METHODS TO THE STUDY OF RESISTANCE TO CORROSION IN AQUEOUS MEDIUM. Quarterly Report No. 1 (Parts 1 and 2) April 1–June 30, 1962. (Brussels. Universite). Work Performed under United States–Euratom Joint Research and Development Program. Contract 081-62-5RDB. 9p. A translation.

The effects of oxygen dissolution were studied in the oxidation of cadmium. The results can be explained by assuming that the oxygen-saturated region is a reserve from which nuclei feed themselves during growth. The status of the research project on the use of the impedance bridge method in studies of metal corrosion resistance is outlined. (D.L.C.)

8746 OXIDATION KINETICS OF NIOBIUM AND ITS COMPOUNDS. P. M. Arzhanyi, R. M. Volkova, and D. A. Prokoshkin. Issled. po Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met., 7: 214-20(1961).

Investigations were made on Nb samples with the chemical composition: 98.9% Nb, 0.4% Ta, 0.15% Pb, 0.13% Fe, 0.08% N, 0.09% O, 0.01% Si, and 0.14% C. The diffusion layer was analyzed by metallographic, x ray and x-ray spectral methods and microhardness was measured. In the process of saturating Nb with Ti and Si, a diffusion layer of a complex structure and composition was formed. At 900 to 1100°C a layer with a microhardness of about 1200 kg/mm^2 was formed, and at 1200 to 1300°C 2 layers were formed, the thickness of the second layer being 5 to 6 μ. The thickness of diffusion layers depended on the temperature and time of saturation. At a constant saturation temperature of 1100°C the dependence can be expressed by the formula $X^{2.2} = 17\tau$, where x is the depth of the layer in microns and τ is the time in hours. As a result of the investigation, the oxidation kinetics of the initial Nb and Nb saturated with Ti and Si was established. The kinetics and phase composition of the diffusion layer and oxide film were studied and the activation energy of oxidation was calculated. It was established that the surface of Nb protected by Si and Ti oxidizes at 1200°C almost 1.5 times slower than the surface protected by Si only. (Referativnyy zhurnal, Mashinostroyeniye, No. 15, 1962.)

8747 CORROSION AND ELECTROCHEMICAL PROPERTIES OF TITANIUM, ZIRCONIUM AND TITANIUM–ZIRCONIUM ALLOYS IN ACID SOLUTIONS. [PART] II. V. V. Andreeva and A. I. Glukhova (Inst. of Physical Chemistry, Moscow). J. Appl. Chem. (London), 12: 457-68(Oct. 1962).

The corrosion and electrochemical behavior of titanium, zirconium, and titanium–zirconium alloys in solutions of sulfuric, nitric, and phosphoric acids and also in mixtures of nitric and phosphoric acids, were investigated. Alloying titanium with zirconium increases the titanium corrosion-resistance in sulfuric acid solutions at 100° when the concentration of the latter is 80%. At concentrations higher than that neither of the metals nor titanium–zirconium alloys are stable. In phosphoric and nitric acid solutions, titanium–zirconium alloys have no advantage over titanium and zirconium. (auth)

8748 THERMAL DESIGN OF LIQUID METAL GRAVITY REFLUX CAPSULES. Walter Unterberg (North American Aviation, Inc., Canoga Park, Calif.). AIChE Preprint 127. New York, American Institute of Chemical Engineers, 1962. 41p. $0.50.

Gravity reflux capsules are useful for determining the compatibility of boiling and condensing liquid metals with solid materials of construction. A proper evaluation of capsule corrosion data requires knowledge of the reflux flow details, which frequently cannot be observed. The aim of this paper is to furnish data for design of a capsule to

provide a desired reflux regime, or determination of the regime for a given capsule. Expressions relating the fluid dynamics and heat transfer inside the capsule to the capsule geometry and thermal environment are derived from simple heat and mass balances. Numerical inputs are based on a survey of present knowledge of liquid metal pool boiling and vertical wall condensation, in which the low Prandtl number of liquid metals is significant. The design calculation procedure is itemized and applied in a numerical example of an alkali metal at high temperature. The case of nonmetallic high Prandtl number liquids is treated in the Appendix. (auth)

8749 BERYLLIUM ALLOYS. Thomas Raine and James Alan Robinson (to Associated Electrical Industries Ltd.). British Patent 911,381. Nov. 28, 1962. Filed Dec. 2, 1960.

A Be–Ca alloy is described which has good corrosion resistance to moist, hot CO_2 and steam without substantial sacrifice of neutron transparency. (R.J.S.)

8750 IMPROVEMENTS IN ACID RESISTANT ALLOYS. (to Metallwerk Plansee Aktiengesellschaft). British Patent 911,630. Nov. 28, 1962. Priority date June 20, 1958, Austria.

Tungsten and/or Mo are alloyed to Ta and/or Nb to produce alloys resistant to fluorine-containing fluids. (R.J.S.)

8751 COATED CARBON ELEMENT FOR USE IN NUCLEAR REACTORS AND THE PROCESS OF MAKING THE ELEMENT. Robert J. Pyle and G. L. Allen (to U. S. Atomic Energy Commission). U. S. Patent 3,073,717. Jan. 15, 1963.

This patent relates to a carbide-nitride-carbide coating for carbon bodies that are to be subjected to a high temperature nuclear reactor atmosphere, and a method of applying the same. This coating is a highly efficient diffusion barrier and protects the C body from corrosion and erosion by the reactor atmosphere. Preferably, the innermost coating is Zr carbide, the middle coating is Zr nitride, and the outermost coating is a mixture of Zr and Nb carbide. The nitride coating acts as a diffusion barrier, while the innermost carbide bonds the nitride to the C body and prevents deleterious reaction between the nitride and C body. The outermost carbide coating protects the nitride coating from the reactor atmosphere. (AEC)

Fabrication

Refer also to abstract 10063.

8752 (AD-270900) EXPLOSIVE FORMING. An ASTIA Report Bibliography. Katye M. Gibbs, comp. (Armed Services Technical Information Agency, Arlington, Va.). Feb. 1962. 42p.

Over 300 references on explosive forming are presented covering the period from 1942 to February 1962. AD reports, ATI reports, commercial papers, patents, and periodicals and journals are covered. (M.C.G.)

8753 (CVNA-43) UO_2 FUEL FABRICATION BY EXTRUSION. W. E. Baily (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). Feb. 1, 1960. For Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C. Contract [AT(30-1)-2289]. 39p.

The development program on the fabrication of fuel rods by extrusion is presented. A discussion of the limited investigations of parameters affecting the extrusion of UO_2 is given. It is concluded that additional work very likely could prove extrusion to be a technically and economically feasible technique for the manufacture of fuel elements. (auth)

8754 (EURAEC-52) URANIUM OXIDE EXTRUSION. Quarterly Report No. 1. (5th Quarterly). (Compagnie Industrielle des Combustibles Atomiques Frittés, Corbeville, par Orsay (Seine-et-Oise), France). Dec. 15, 1960. Work Performed under United States–Euratom Joint Research and Development Program. Contract 030-60-9RDF. 14p.

Studies were carried out in an attempt to increase the density of extruded UO_2 rods. Extruded rods of density 10.2 to 10.3 g/cm^3 were made from UO_2 powders of average specific surface (6 to 7 m^2/g) by applying an isostatic pressing operation to the rods before sintering. The effects of addition of sintered UO_2 particles, TiO_2, and Nb_2O_5 were studied and found negative. (D.L.C.)

8755 (LA-2769) PREPARATION OF FOILS FOR NUCLEAR PARTICLE TARGETS. Larry D. F. Allen (Los Alamos Scientific Lab., N. Mex.). Sept. 1962. Contract W-7405-eng-36. 37p.

Cleaning of backings for foils is discussed as well as the actual preparation of foils by vacuum evaporation, vapor deposition, electro-deposition, and sundry other techniques. Techniques used for preparation of foils from elements in each group of the periodic table are given, and a chart shows techniques applicable to the various elements. (D.C.W.)

8756 (NMI-9701.3) DEVELOPMENT OF IMPROVED FABRICATION METHODS, PROCESS AND TECHNIQUES FOR PRODUCING TYPICAL AIRCRAFT SHAPES FROM BERYLLIUM. Interim Technical Documentary Progress Report for the Period ending October 31, 1962. R. G. Jenkins and J. M. Siergiej (Nuclear Metals, Inc., Concord, Mass.). Dec. 28, 1962. Contract AF33(657)-8783. 20p.

In a program to develop a complete manufacturing process for the production of beryllium channels, techniques are being sought for drawing to obtain a final product meeting specifications more rigorous than are obtainable by direct extrusion. Progress in designing and procuring the special tooling required to draw complex shapes at elevated temperature is described, and the first set of draw dies is evaluated with respect to design and quality. Three experimental draw attempts have been made on U-channels, in addition to draw tests on flats. (auth)

8757 (NP-12446) THE DEVELOPMENT OF OPTIMUM MANUFACTURING METHODS FOR COLUMBIUM ALLOY SHEET. Interim Report No. VIII, September 15–December 15, 1962. A. L. Mincher (Du Pont de Nemours (E. I.) & Co. Metals Center, Baltimore). Contract AF33 (600)-39942. 35p.

The X-110 niobium alloy was processed to 28 in. wide sheet panels in three gages, 0.020, 0.040, and 0.063 in. Ingot preparation, extrusion breakdown, and rolling procedures are described, and the results of initial evaluation of sheet quality and tensile properties are reported. (auth)

8758 (EURAEC-458) STAINLESS PLATINGS OF LARGE-THICKNESS STEELS. Quarterly Report No. 4, July 1 to September 30, 1962. (Ghent. Rijksuniversiteit and Soudometal, S. A., Brussels). Work Performed under United States–Euratom Joint Research and Development Program. Contract 040-61-9RDB. 46p. A translation.

Examination of plating carried out in horizontal, cornice, and vertical positions shows a good correlation between bending test results, minimum ferrite content in the structure, and minimum preferred orientation. When based on these criteria, the vertical welding position gave the

best results, followed by the cornice and horizontal positions. Only the property of chemical composition heterogeneity formed an exception to the correlation. This heterogeneity is maximum for the vertical position and minimum for the horizontal position. This indicates that the influence of dilution upon mechanical properties is small. Only the surface which is in contact with the corrodant seems to count from the point of view of chemical homogeneity. (R.J.S.)

8759 (EURAEC-486) WELDING OF LARGE-THICKNESS STEELS. Special Report No. 4. (Ghent. Rijksuniversiteit and Soudometal, S. A., Brussels). [1962]. Work Performed under United States–Euratom Joint Research and Development Program. Contract 042-61-9RDB. 32p. A translation.

A general survey is presented of the research on the welding of large-thickness steels, and the hypotheses arrived at in the course of research are reviewed. Most of the research was carried out on SOUDOTENAX 56, a low-alloy Mo steel. Welding products for manual and automatic welding were studied. The introduction of tenso-thermal fragilizations by welding and the relaxation of stresses by heat treatment were studied. Tests for fragile rupture susceptibility are discussed. (D.L.C.)

8760 (FTD-TT-62-1244) ARGON-ARC AND ELECTRON-RAY WELDING OF TANTALUM AND NIOBIUM. N. V. Grevtsev. Translated from Svarochn. Proizv., No. 2, 8-12(1962). 13p.

A comparative investigation was made of the welding of Ta and Nb and of the properties of welded Ta and Nb joints. In argon-arc welding, the seam metal is saturated with atmospheric N_2 and O_2, leading to hardened welded joints. Etching figures in the microstructure of the welded seams show contamination with gases, but the joints retain sufficient plasticity. The welding method has no noticeable effect on the ultimate strength of welded joints at room temperature. In the argon-arc welding of Ta, best results are obtained with a nonconsumable Ta electrode, while Nb should be welded with a W electrode. Strength changes of Ta and Nb at high temperatures are similar to each other. (D.L.C.)

8761 FLAME SPRAYED ZIRCONIA FILMS FOR FUEL CELL COMPONENTS. J. L. Bliton, H. L. Rechter, and Y. Harada (Illinois Inst. of Tech., Chicago). Am. Ceram. Soc. Bull., 42: 6-9(Jan. 1963).

One- and two-inch diameter 4 to 10 mil thick, lime-stabilized zirconia films were produced by flame spraying over a soluble salt-coated metal substrate, and then dissolving the salt to free them. Films were densified and rendered low in air permeability (at room temperature) by impregnation and firing treatments. A study of electrode attachment to films revealed that platinum coatings from a paste was satisfactory. (auth)

8762 SEMI-CONTINUOUS HOT PRESSING. E. H. Zehms and J. D. McClelland (Atomics International, Canoga Park, Calif.). Am. Ceram. Soc. Bull., 42: 10-12 (Jan. 1963).

Equipment and techniques used in semicontinuous hot pressing are described. Preliminary data are presented on the effects of time and temperature on the final density of high-purity beryllia. Densities greater than 98% were achieved at time cycles as short as 10 minutes and at temperatures as low as 1100°C. It is concluded that, under suitable conditions, semicontinuous hot pressing may compete both technically and economically with sintering techniques. (auth)

8763 FABRICATING PLUTONIUM FOR BETTER PERFORMANCE. Victor W. Storhok (Battelle Memorial Inst., Columbus, Ohio). Nucleonics, 21: No. 1, 38-42(Jan. 1963).

Difficulties in using plutonium as a fuel (i.e., cost of fabrication by remote handling) are discussed; and fabrication techniques for Al-Pu, Pu-Fe, U-Pu-fissium, U-Pu-Mo, and PuO_2-UO_2 are described. Performance is also evaluated. Other plutonium fuel materials being investigated are solid-solution alloys (Th-Pu, U-Nb-Pu, Zr-Pu, Nb-Pu-Si), liquid-metal fuels including Ce-Pu-Co alloys, ceramic fuels (PuC and PuC-UC mixtures, PuN, Pu_2Si_3, and $PuSi_2$), cermet fuels (PuC and PuO_2), and cost dispersion alloys (Fe-Pu alloys). (D.C.W.)

8764 CUTTING UP THE HRE-2 CORE VESSEL. Peter P. Holz, Carl M, Smith, and Leonard J. Shersky (Oak Ridge National Lab., Tenn.). Nucleonics, 21: No. 1, 72-3(Jan. 1963).

After completion of experimental runs, specimens were cut from the core-wall of the Homogeneous Reactor Experiment No. 2 using a remotely controlled underwater heliarc. Equipment and technique are described. (D.C.W.)

8765 TECHNOLOGY OF PROCESSING LANTHANUM BORIDE WITH A PLASMA JET. G. A. Kudintseva and V. K. Popov. Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 4, 56-8(July-Aug. 1962). (In Russian)

The application of lanthanum boride coating on refractory metals by means of a plasma jet was investigated. It is shown that on melting lanthanum boride in the jet, it is possible to obtain practically poreless samples of a stoichiometric composition readily undergoing electropolishing. The use of a plasma jet makes it possible to obtain cathodes of complex form from lanthanum boride. (auth)

8766 WELDABILITY OF BORON STEEL ALLOYED WITH 1.20% BORON. C. D. Brons (General Electric Co., Richland, Wash.). Welding J. (N. Y.), 42: 13-22(Jan. 1963). (HW-SA-2649)

In the design of the NPR at Hanford, it was determined by various tests, calculations, and experiments that a relatively low carbon, $1\frac{1}{16}$ in. thick steel plate, alloyed with 1.10 and 1.50% natural boron, would effectively serve as a thermal neutron shield. Three types of welds are reported on as follows: butt welds in the boron steel, fillet welds to join carbon steel support brackets to the boron plate, and fillet welds to join cooling pipes to the plate. (W.D.M.)

8767 FUSION WELDING OF END CAPS IN BERYLLIUM TUBES. R. G. Gilliland and G. M. Slaughter (Oak Ridge National Lab., Tenn.). Welding J. (N. Y.), 42: 29-36 (Jan. 1963).

Beryllium appears attractive as a potential cladding material for fuel elements for advanced gas cooled reactor applications. As a result, a program was undertaken to develop procedures for successfully fabricating beryllium-clad fuel elements and to determine the mechanical properties of these welds. Welding parameters affecting the integrity of tungsten-arc welds in 0.30 in. OD × 0.040 in. wall tubing were investigated. Based on a study of three joint designs, it was determined that the edge-fusion type proved to be better than either the butt- or plug-type design. To eliminate root cracking in the welds, it was necessary to obtain a very tight fit-up of the end cap and tube by tapering the joint about 3 deg. Additional refinements such as preheating the joint to 1400°F under a suitable cover gas of argon reduced the propensity of crack formation and propagation during welding and cool-down. An evaluation of seven different lots of tubing produced

by six fabrication processes showed that welds in extruded tubing exhibited a tendency to be porous, whereas welds in machined tubing did not. All the material tested had welds of comparable strengths, having shear strength in the order of 20,000 psi at room temperature and 10,000 psi at 1100°F (593°C). To date, no service failures attributable to defective welds have been reported for approximately 300 tube-burst specimens tested in or out of the reactor. (auth)

8768 STEEL STRENGTH AND DUCTILITY RESPONSE TO ARC-WELDING THERMAL CYCLES. C. S. Williams (Westinghouse Research and Development Center, Pittsburgh). Welding J. (N. Y.), 42: 1-s-8-s(Jan. 1963).

Increased performance requirements for materials and the need to use welding for fabrication have heightened interest in methods to assess the cracking potential of materials during welding. Such cracking is not always anticipated from conventional metallurgical evaluations. A novel approach to this problem was provided by the "Hot Ductility" test developed by Nippes and Savage. This report describes the performance of materials in a test similar to that of Nippes and Savage. The test is, however, modified by the use of higher maximum test temperatures and the provision of a new index of merit to indicate the relative susceptibility to cracking. The use of higher test maxima increases the amount of the change produced in test properties in a manner which appears to be associated with the degree of cracking sensitivity, thus enhancing the capabilities of the test method. The procedure has been found useful in evaluating austenitic stainless alloys. The opportunity to determine the applicability of this test to high-strength ferritic alloys was presented through a program to develop improved, weldable steels of high strength. The results are encouraging. A discontinuity in the curve of strength vs. temperature was found to be associated with the temperature at which the catastrophic loss of ductility occurs. (auth)

8769 WELDING OF COLUMBIUM-1% ZIRCONIUM. E. A. Franco-Ferreira and G. M. Slaughter (Oak Ridge National Lab., Tenn.). Welding J. (N. Y.), 42: 18-s-24-s (Jan. 1963).

A study was conducted to investigate the aging behavior of welds in the Nb-1 wt % Zr alloy. This embrittlement, which appears to be that of the classical aging and overaging type, occurs in the temperature range 1500-1800°F. A special controlled-atmosphere chamber was constructed for making the welds, and a number of mechanical properties studies were made. Bend tests provided a ready means for qualitatively following the progress of aging, while tensile and hardness tests did not appear to be reliable indicators of change in ductility. Postweld annealing in the range 1900-2200°F was found to result in overaging, and no embrittlement was noted after subsequent heating at lower temperatures. Metallographic examination was found to provide a good correlation between annealing time and temperature and the amount of precipitate which was present. Welds with high oxygen-impurity levels may also be prevented from aging by the proper annealing treatment, but microcracking is apt to occur when welding highly contaminated material. (auth)

8770 HOT-PRESS SINTERING KINETICS OF METAL POWDERS. Robert Gustav Carlson. Thesis, Cincinnati, Univ. of Cincinnati, 1962. 138p.

Lead alloy spheres were hot-pressed at four temperatures of 300, 330, 350, and 400°F, at a constant pressure of 1165 psi; identically, four compressive pressures were applied at 665, 1165, 1665, and 2500 psi, while the temperature was held constant at 400°F. In the second part, hot-pressings were made on four types of Nb particles: Nb spheres (30/35 mesh); fine mesh Nb powder (-200 mesh); a slightly coarser mesh Nb powder (-200 +350 mesh); and prealloyed 50% tungsten-50% Nb powder (-200 +350 mesh). The powders were pressed in the temperature range between 2750 to 3825°F at pressures up to 4000 psi. Because of the need for the higher temperatures, experiments were made to determine the necessary conditions for a controlled environment under pressure. From the proximity experiments, tantalum sheet was found to be an excellent carbon barrier during the compaction of the Nb particles. Also in the experiments it was determined that there is no significant difference in the densification rates between the static and the fluctuating (hydraulic press) methods of pressure application. Two activation energies, as determined by the rates of sintering were observed to exist in the hot-pressing process. The one at higher temperatures, was of the order of the activation energy for self diffusion, and, hence, is believed to be controlled by a diffusion process. The activation energy at lower temperature was observed to be distinctly different. It is hypothesized that the lower temperature activation energy can be attributed to a glide mechanism of material flow, and its magnitude is determined by the type of dislocation interaction. It appears that the yield strength of the material has a significant effect on the rates of densification in hot-pressing. Equations developed in the studies are listed. (Dissertation Abst., 23: No. 5, Nov. 1962)

8771 IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF FUEL ELEMENTS FOR NUCLEAR REACTORS. (to U. S. Atomic Energy Commission). British Patent 911,194. Nov. 21, 1962. Priority date Mar. 24, 1960, United States.

A method for fabricating fuel plate assemblies of the MTR type is outlined which does not use brazing techniques. The method comprises dovetailing the lateral edges of the plates, inserting the dovetailed edges into recesses in a pair of supporting side members, and compressing the side members to close the recesses onto the dovetailed edges. A jig for carrying out the method is described. (D.L.C.)

8772 IMPROVEMENTS IN METHODS FOR MAKING URANIUM MONOCARBIDE ARTICLES. (to Commissariat à l'Energie Atomique). British Patent 911,957. Dec. 5, 1962. Priority date Nov. 6, 1959, France.

A method is given for making UC bodies of high density from stoichiometric mixtures of U and C powders. The method comprises packing the mixture in a mold by mechanical vibration, heating the mixture to a final temperature of 1200°C at varying rates, and cooling the mixture. The heating program preferably is 100°C/hr from ambient temperature to 250°C, 2 hr at 250°C for degassing and decomposition of UH_3, 200°C/hr from 250 to 450°C, 100°C/hr from 450 to 750°C, 50°C/hr from 750 to 900°C for the $\beta \rightarrow \gamma$ transformation, 200°C/hr from 900 to 1200°C, 2 hr at 1200°C for completing the reaction, and cooling at 300°C/hr. The resulting body has a density of 7.5 g/cm^3 and may be further densified by electrothermal treatment. (D.L.C.)

8773 A PROCESS OF COATING ELEMENTAL CARBON WITH SILICON CARBIDE. (to Nissan Chemical Industries Co., Ltd.). British Patent 913,577. Dec. 19, 1962. Priority date Aug. 18, 1959, Japan.

A method is provided for the treatment of elemental C to reduce C loss at high temperatures. The elemental C is

treated with a silica sol and heated to achieve at least partial conversion of silica to SiC. (R.J.S.)

8774 IMPROVEMENTS IN OR RELATING TO METHOD OF PREPARING URANIUM DIOXIDE. Peter Best, Sidney Roy Twigg, and Charles Moss (to United Kingdom Atomic Energy Authority). British Patent 913,684. Dec. 28, 1962. Filed July 8, 1958.

A method is outlined for preparing non-stoichiometric uranium dioxide suitable for subsequent fabrication into high density bodies. (R.J.S.)

8775 IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF URANIUM–CARBON ALLOYS. Jack Williams, Charles Brian Davis, and Michael Colin Regan (to United Kingdom Atomic Energy Authority). British Patent 914,153. Dec. 28, 1962. Filed Sept. 8, 1959.

A method of producing a dense C–U alloy, which may include Pu, involves cold-compacting a mixture of U powder and C powder and, if desired, Pu powder. The mixture is heated to 1000 to 1125°C in a furnace. The heat of reaction causes the temperature of the mixture to rise above the melting point of U. (R.J.S.)

8776 IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF URANIUM–CARBON ALLOYS. Jack Williams and Michael Colin Regan (to United Kingdom Atomic Energy Authority). British Patent 914,154. Dec. 28, 1962. Filed Sept. 8, 1959.

A method is described for producing dense C–U alloys, which may also contain Pu, by cold-compacting and sintering at 800°C a mixture of C powder and U powder. Iron is included in the form of an intermetallic compound of Fe and U. Plutonium powder may also be included. (R.J.S.)

8777 IMPROVEMENTS IN OR RELATING TO METHODS OF PRODUCING CARBON-IMPREGNATED ARTEFACTS. Kenneth Wallace Carley-Macauly and Malcolm Mackenzie (to United Kingdom Atomic Energy Authority). British Patent 914,776. Jan. 2, 1963. Filed Apr. 26, 1960.

A method is described for the production of carbon bodies having low permeability to gases and containing fissile or fertile material. (R.J.S.)

8778 METHOD OF PREPARING HOLLOW TYPE HIGH DENSITY CERAMIC NUCLEAR FUEL ELEMENTS. (to Mitsubishi Atomic Power Industries, Inc.). British Patent 915,438. Jan. 9, 1963. Priority date Oct. 15, 1959, Japan.

An annular space between two cylindrical sheaths disposed coaxially is filled with ceramic or cermet nuclear fuel material and then sealed. The mass is densified and sintered by rotary swaging. (R.J.S.)

8779 METHOD OF PRODUCING URANIUM METAL. (to United Kingdom Atomic Energy Authority). French Patent 1,235,630. May 30, 1960.

The patent describes the production of a uranium fuel rod, containing 200 to 500 ppm Fe and 500 to 1200 ppm Al, which is beta-quenched and alpha-annealed to obtain a peripheral grain structure refined by a factor of 6 to 30 from the largest initial grain size 2.0 to 3.0 mm. (NPO)

8780 PREPARATION OF HIGH DENSITY SINTERED URANIUM DIOXIDE FOR NUCLEAR REACTORS. (to Associated Electrical Industries Ltd.). French Patent 1,264,209. May 8, 1961.

Uranium oxide, having the composition $UO_{2.1}$–$UO_{2.25}$, is pulverized so that it acquires a surface of 2 m^2/g and mixed with such a quantity of $(NH_4)_2$ $PtCl_6$ sol. that the paste contains 0.1 w/o Pt. The paste is compacted, sintered in an inert atmosphere at 1400°C, and finally heated at 1200°C in hydrogen. The final UO_2 compact has a density of 10.73 to 10.90 g/cm^3. (NPO)

8781 METHOD OF PREPARING URANIUM–CARBON ALLOYS. (to United Kingdom Atomic Energy Authority). French Patent 1,271,771. Aug. 7, 1961.

Dense uranium–carbon or uranium–plutonium–carbon alloys are prepared by cold compacting pulverized U, C, and Pu and introducing the compacts into a furnace which is held at 1000 to 1125°C. See also French patent No. 1,271,772. (NPO)

8782 METHOD OF PREPARING DENSE URANIUM–CARBON ALLOYS. (to United Kingdom Atomic Energy Authority). French Patent 1,271,772. Aug. 7, 1961.

Dense U–C or U–Pu–C alloys are prepared by cold compacting and agglomerating at 800°C a mixture of pulverized U, C (Pu), and UFe_2, the UFe_2, content being 3.1 to 31 w/o, preferably 10 w/o. Preferably the U/C ratio is such that the final product constitutes an intimate mixture of UC and UFe_2. See also French patent No. 1,271,771. (NPO)

8783 FUEL ELEMENT FOR NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,280,534. Nov. 20, 1961.

When Be containing more than 0.5 ppm U, e.g. 25 ppm, is applied as canning material, the jacket is coated on the outside with a layer of at least 10 microns of Be containing less than 0.5 ppm U. (NPO)

8784 FUEL ELEMENT FOR NUCLEAR REACTORS AND ITS METHOD OF MANUFACTURE. (to Nukem Nuclear–Chemie und–Metallurgie). French Patent 1,283,560. Dec. 26, 1961.

A metallic U slug is bonded to an Al jacket by means of a first layer of Ni (5 to 7 micron), an intermediate layer of Cr (4 to 6 micron), a second layer of Ni (3 to 5 micron), and a layer of Cu, the latter facing the Al. The bonding is effected at 600°C and 80 to 100 atm. (NPO)

8785 IMPROVEMENTS IN THE MANUFACTURE OF NUCLEAR FUEL ELEMENTS. (to Mitsubiski Atomic Power Industries, Inc.). French Patent 1,284,135. Jan. 2, 1962.

In the manufacture of fuel elements by the swaging of powder-filled stainless steel tubes the interior surface of the tubes is previously polished to remove a layer of at least 2 micron. (NPO)

8786 METHOD OF MANUFACTURE AND OPERATION OF FUEL ELEMENTS FOR NUCLEAR REACTOR. H. N. Schludi. French Patent 1,285,735. Jan. 15, 1962.

The patent claims the application of external heat to fuel elements, e.g., by means of an electrical coil, during their manufacture, i.e., filling of cans with nuclear fuel during their insertion in the reactor core and in the reactor when the latter is shut down or is operated at a lower power level in order to prevent irregular differences in dilatation between the fuel and the can. Thus the fuel can be charged and kept in the liquid or in the desired allotropic state. (NPO)

8787 METHOD OF PREPARING A FUEL ELEMENT FOR A NUCLEAR REACTOR. Joseph J. Hauth and Robert J. Anicetti (to U. S. Atomic Energy Commission). U. S. Patent 3,067,117. Dec. 4, 1962.

A method is described for preparing a fuel element for a nuclear reactor. According to the patent uranium dioxide is compacted in a metal tube by directing intense sound waves at the tube prior to tamp packing or vibration compaction of the powder. (AEC)

8788 MECHANICALLY-JOINED PLATE-TYPE ALUMINUM-CLAD FUEL ELEMENT. J. H. Erwin (to U. S. Atomic Energy Commission). U. S. Patent 3,068,160. Dec. 11, 1962.

A method of fabricating MTR-type fuel elements is described wherein dove-tailed joints are used to fasten fuel plates to supporting side members. The method comprises the steps of dove-tailing the lateral edges of the fuel plates, inserting the dove-tailed edges into corresponding recesses which are provided in a pair of supporting side members, and compressing the supporting side members in a direction so as to close the recesses onto the dove-tailed edges. (AEC)

8789 METHOD OF OBTAINING AN IMPROVED WELD IN INERT ARC WELDING. Thomas B. Correy (to U. S. Atomic Energy Commission). U. S. Patent 3,068,352. Dec. 11, 1962.

A method is reported for inert arc welding. An a-c welding current is applied to the workpiece and welding electrode such that the positive portion of each cycle thereof, with the electrode positive, has only sufficient energy to clean the surface of the workpiece and the negative portion of each cycle thereof, with the electrode negative, contains the energy required to weld. (AEC)

8790 PREPARATION OF THORIUM INTERMETALLIC COMPOUND DISPERSION. Robert J. Teitel and George B. Cobel (to Dow Chemical Co.). U. S. Patent 3,069,256. Dec. 18, 1962. Filed Aug. 17, 1960.

A method is described for preparing a readily pumpable dispersion of intermetallic compounds of Th with Bi and with Pb in fine particulate form in Bi, Pb, or Bi–Pb alloy. (R.J.S.)

8791 POLYMERIZING METHOD AND APPARATUS FOR CARRYING OUT THE SAME. John H. Coleman (to Radiation Research Corp.). U. S. Patent 3,069,283. Dec. 18, 1962. Filed Feb. 2, 1959.

An apparatus is described for producing capacitive subcomponents utilizing gas discharge polymerized dielectric films. Conductive surfaces are covered with dielectric in a plasma-phase polymerization process. (R.J.S.)

8792 PRODUCTION OF ZIRCONIUM HYDRIDE. Ulrich Merten (to General Dynamics Corp.). U. S. Patent 3,070,526. Dec. 25, 1962. Filed Jan. 29, 1958.

A process is described for uniformly hydriding solid pieces of Zr and Zr alloys of considerable size without substantial cracking. Fully fabricated hydrides within fairly small tolerances can be produced by this method. (R.J.S.)

8793 NUCLEAR FUEL PLATE AND PROCESS FOR MAKING SAME. Benjamin Litt (to Sylvania Electric Products Inc.). U. S. Patent 3,071,526. Jan. 1, 1963. Filed Aug. 30, 1960.

A process is outlined for making a compartmentalized reactor fuel plate which is resistant to bulging due to fission gases. In the process, a honeycomb structure of a cladding material such as stainless steel is welded to the inside of a tray of cladding material with externally protruding dents in its bottom. UO_2 powder is added to the tray in vacuum or inert gas and vibrated to a density of ≥80% theoretical density. A cover plate is welded to the top of the tray, and the box is then hot compressed to the desired thickness and to effect fuel-clad bonding. The externally protruding dents are flattened to further densify the UO_2. (D.L.C.)

8794 PROCESS AND DEVICE FOR EXTRUSION. Charles Sauve (to Commissariat à l'Energie Atomique). U. S. Patent 3,072,251. Jan. 8, 1963. Priority date Jan. 27, 1959, France.

An extrusion process is described in which a billet to be extruded and a lubricant are placed in a container provided with a die. (R.J.S.)

8795 METHOD OF MAKING ALLOYS OF SECOND RARE EARTH SERIES METALS. Richard D. Baker and Benjamin R. Hayward (to U. S. Atomic Energy Commission). U. S. Patent 3,072,475. Jan. 8, 1963.

This invention relates to a process for alloying the second rare earth series metals with Mo, Nb, or Zr. A halide of the rare earth metal is mixed with about 1 to 20 at. % of an oxide of Mo, Nb, or Zr. Iodine and an alkali or alkaline earth metal are added, and the resulting mixture is heated in an inert atmosphere to 350°C. (AEC)

8796 DISPERSION HARDENING OF URANIUM METAL. W. Arbiter (to U. S. Atomic Energy Commission). U. S. Patent 3,073,698. Jan. 15, 1963.

A method of hardening U metal involves the forming of a fine dispersion of UO_2. This method consists of first hydriding the U to form a finely divided powder and then exposing the powder to a very dilute O gas in an inert atmosphere under such pressure and temperature conditions as to cause a thin oxide film to coat each particle of the U hydride. The oxide skin prevents agglomeration of the particles as the remaining H is removed, thus preserving the small particle size. The oxide skin coatings remain as an oxide dispersion. The resulting product may be work-hardened to improve its physical characteristics. (AEC)

8797 REFRACTORY METAL TUBE DRAWING. Charles H. Bean and Frank J. Karasek (to U. S. Atomic Energy Commission). U. S. Patent 3,075,637. Jan. 29, 1963.

A lubricant for drawing Zr and other refractory metals is described. Metallic Cu powder is added to a solution of acrylic resin in chlorinated hydrocarbon solvent. (AEC)

Properties and Structure

Refer also to abstract 10062.

8798 (ANL-6495) A STUDY OF URANIUM–FISSIUM ALLOYS CONTAINING TECHNETIUM. Addendum to Final Report—Metallurgy Program 4.1.23. R. W. Bohl and M. V. Nevitt (Argonne National Lab., Ill.). Oct. 1962. Contract W-31-109-eng-38. 28p.

The equilibrium microstructures and the kinetics of gamma decomposition of uranium-fissium alloys containing technetium were studied and compared with the characteristics of similar alloys which did not contain technetium. The technetium concentration in the fissium was 12.5 wt % and the uranium-fissium alloys that were examined contained from 3 to 10 wt % fissium. The presence of technetium did not result in the presence of any new phases; it produced only minor changes in the phase relationships and in the stability of the gamma-uranium solid solution. Studies of aging behavior and of the structure of slowly cooled alloys indicated that the gamma is slightly more sluggish in its transformation characteristics in the presence of technetium. On this basis, it appears that the property measurements made earlier on uranium–fissium alloys which did not contain technetium can be reliably applied to true fissium alloys. (auth)

8799 (ANL-FGF-397) SINTERING AND PROPERTIES OF URANIUM AND THORIUM MONOSULFIDES. P. D. Shalek and J. H. Handwerk (Argonne National Lab., Ill.). Oct. 8, 1962. Contract [W-31-109-eng-38]. 18p. (UAC-6948)

Monosulfide powders were prepared by reacting powder, resulting from hydriding-dehydriding of metal turnings, with H_2S. Specimens were isostatically pressed and fired. Sintering studies, lattice parameters, and groove etching

are discussed. The following properties were determined: melting point, electric resistivity, thermal conductivity, oxidation behavior, and compatibility with metals. (R.J.S.)

8800 (CAL-86-P) COMBUSTION OF METALS. George H. Markstein (Cornell Aeronautical Lab., Inc., Buffalo). Nov. 1962. Project SQUID. Contract Nonr-3623(00). 62p.

Compared with the present knowledge of combustion of conventional fuels, the burning of metals is as yet poorly understood. Primarily responsible for the current lack of understanding is the formation of condensed-phase products. One consequence of this characteristic of metal flames is the upper limit on flame temperature imposed by the equilibrium between condensed-phase oxide and its vaporization and decomposition products. Lack of reliable thermodynamic data required for equilibrium computations is one cause of difficulties encountered in the field. The presence of condensed-phase products also implies the predominant participation of heterogeneous reactions. Ignition of metals is thought to be always preceded by slow oxidation that takes place on the metal surface. The ignition temperatures of metals have been linked with their low-temperature oxidation properties. This approach has been reasonably successful with metals that do not form a protective oxide layer. However, difficulties have been encountered with metals that form protective layers, particularly if metal and oxide are mutually soluble. Further complications arise when the metal is finely subdivided. Ignition properties of metal powders depend strongly on particle concentration, owing to cooperative effects that have not yet been analytically treated. After ignition, the burning process may either continue to take place on the surface of a usually molten oxide layer covering the metal, or the reaction may occur in the surrounding vapor phase. Even in the latter case, heterogeneous reactions on the surface of growing oxide-smoke particles may play a predominant role. Surface burning has been observed to take place, without exception, if the oxide is more volatile than the metal. Vapor-phase burning may occur only if the metal is more volatile than the oxide, but may be suppressed by formation of a protective oxide layer, or by reduction of flame temperature below the metal boiling point, owing to heat losses. Suppression of vapor-phase burning has been observed primarily with aluminum under certain conditions. Most of the studies of metal combustion have thus far been of an exploratory and often primarily qualitative nature. Various transport processes have been suggested as rate-limiting steps in metal burning, but the experimental evidence is often inconclusive. Chemical reaction rates are usually regarded as fast compared with transport processes, although there are indications, such as the influence of small amounts of water vapor, that chemical effects may become rate-determining. Knowledge of reaction kinetics and mechanisms is as yet almost totally lacking. A trend towards careful control of experimental conditions, and towards measurement by a greater variety of techniques, is discernible in recent work. Among these, spectroscopy will undoubtedly continue to yield very valuable information. The method of flash vaporization combined with absorption spectroscopy should be especially useful for metal-combustion studies. A study using mass spectrometry has been recently started. Work in related fields, such as high-temperature chemistry, evaporation and condensation, surface processes, and transport phenomena, is of utmost importance for improving the understanding of metal combustion. (auth)

8801 (DMIC-177(Vol.2)) THERMAL RADIATIVE PROPERTIES OF SELECTED MATERIALS. W. D. Wood, H. W. Deem, and C. F. Lucks (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Nov. 15, 1962. Contract AF33(616)-7747. 470p.

A compilation of data on thermal radiative properties is presented including a discussion of the basic fundamentals and methods for measuring these properties. Thermal radiative data (emittance, reflectance, and absorptance) are included for the following materials: titanium and its alloys; stainless steels; iron, nickel, and cobalt superalloys; the refractory metals (chromium, niobium, molybdenum, tantalum, and tungsten) and their alloys; coated materials for elevated-temperature service; and ceramics and graphite. (auth)

8802 (EURAEC-381) PHYSICAL PROPERTIES OF UO_2 SINGLE CRYSTALS. Quarterly Report No. 3, April 1 – June 30, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). Work Performed under United States – Euratom Joint Research and Development Program. Contract 063-61-10RDB I.1.15. 23p. (R-2146)

The method for measuring densities has been improved. It is found that irradiated crystals have smaller density than unirradiated samples. Some measurements have been performed to study the change in lattice parameter as a function of thermal oxidation. The construction of the parts of the thermal-conductivity-measuring apparatus has been achieved. Soldering experiments have been performed in order to obtain suitable thermal contacts. The temperature-measurement device for low temperature has been considerably improved. Electric conductivity measurements have been extended to higher temperatures. Interesting results are also obtained after reduction of the crystals in a H atmosphere. It appears that the difference in excess O results in a slightly different activation energy. An investigation of preliminary data on the mobility of holes in UO_2 indicates that the current is associated with a hopping motion of the holes. It has been shown that the present conductivity measurements do not indicate definitely whether $\sigma = Ae^{(-\Delta E/kT)}/T$ (as predicted by a hopping model) or $\sigma = Be^{(-\Delta E/kT)}$ (classical formula) represents the behavior of σ vs $1/T$. Although other localization phenomena will be investigated, the activation energy may be associated with the existence of small polarons. Some considerations have also been devoted to the bonding in UO_2. Deformation experiments on UO_2 crystals are in preparation. Tentative etching and polishing experiments gave good results. The image of dislocations has been compared with an existing contrast theory. Qualitative agreement can be obtained only with an improved theory. Quantitative agreement seems doubtful. Anomalous absorption of electrons in uranium oxide will therefore be considered. Photoconductivity measurements have been performed in order to check the band-gap measured previously. Small photoconductivity has been found. The first rough estimate yielded a confirmation of the band-gap value. (auth)

8803 (EURAEC-398) THE DEVELOPMENT OF A NEW DETERMINATION OF THE DUCTILE-BRITTLE TRANSITION TEMPERATURE. Quarterly Report No. M-62-831-26150, April 1, 1962 – June 31, 1962. H. C. van Elst (Netherlands. Nijverheidsorganisatie, TNO, The Hague). Work Performed Under United States — Euratom Joint Research and Development Program. Contract 068-61-11-RDN. 47p.

The Robertson test was chosen for the determination of the crack velocity and for the measurement of the stress

waves emitted by a running crack, this test being generally considered the nearest approach to actual brittle fracture as occurring in practice. These measurements are being done with the object of copying these stress waves with the aid of explosive or electrical discharges on small specimens, in order to arrive at a reliable brittle fracture test method for small pieces of material. In this respect the stress waves generated in the Hopkinson pressure bar by detonation of explosive charges are investigated, as the latter seems to offer promising possibilities for the development of such a test. The character of these stress waves will depend on the geometry and dimensions of the bar and on the amount and type of charges used. (auth)

8804 (EURAEC-463) PHYSICAL PROPERTIES OF UO_2 SINGLE CRYSTALS. Quarterly Report No. 4, July 1–September 30, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucleaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 063-61-10RDB. 37p.

A new furnace for the preparation of larger crystals of UO_2 and for the study of various properties of refractory uranium compounds has been developed. After-heating at the end of the runs avoids quenching and thermal stressing of the deposits. An investigation on the controlled oxidation of single crystals of UO_2 by hydrogen-water vapor and argon-water mixtures has been started. The apparatus for the low-temperature measurements has been finished completely so that the experiments could be started. Depending on the heating power used, values varying between 0.15 and 0.19 at 208°K, 0.06 and 0.08 at liquid nitrogen temperature and 0.20 watt cm^{-1} $°K^{-1}$ at liquid helium temperature were found. These values are higher than those obtained on polycrystalline material. Electrical conductivity measurements between liquid nitrogen temperature and 800°K have been continued on samples with composition in the range $UO_{2.0000} - UO_{2.007}$. The activation energies calculated from the log σ vs. (1/T) curves varied between 0.34 and 0.19 ev depending on the O/U atomic ratio. It was found that the activation energy first decreases as the oxygen content decreases and then levels off in the neighborhood of 0.1% excess oxygen. For the single crystals of UO_2, Hall effect measurements by dc and ac techniques have yielded no measurable response. This indicates that the Hall mobility has to be smaller than 0.04 cm^2/v sec at room temperature. The construction of an apparatus for the measurement of the thermoelectric power in the low temperature range has been nearly finished. Preliminary measurements showed a rather constant value of the thermoelectric power between 170°K and 320°K. The crystal remained p-type in the whole temperature range. Further evidence for the electrical conduction mechanism in UO_2 by small polarons is discussed. The value of the coupling constant α for the lattice-hole interaction, the low mobility leading to high effective masses of the polaron, and the expected jump probability of a hole in UO_2 are arguments in favor of the polaron formation. A qualitative interpretation of the conductivity curves at low temperatures is given using Holstein's theory for small polaron diffusivity. The study of anomalous absorption of electrons in UO_2 and of dislocation has been pursued further. First results of a complementary investigation to UO_2 in another non-metallic structure, wurtzite (lattice defects in wurtzite ZnS) were submitted for publication. (auth)

8805 (HW-75120) ELECTRICAL PROPERTIES OF PLUTONIUM OXIDES. C. E. McNeilly (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 1962. Contract AT(45-1)-1350. 20p.

Preliminary measurements have been made on the electrical resistivity and thermoelectric power of plutonium oxide in the composition range of $PuO_{1.76}$ to $PuO_{2.00}$ from 20 to 1000 C. The normal PuO_{2-x} composition which results from the vacuum sintering of PuO_2 has been shown to exhibit p-type conductivity at room temperature. This changes on heating to n-type which is characteristic of oxygen deficient PuO_{2-x}. Room temperature resistivity and low temperature activation energy varies directly with oxygen content. The activation energy for electronic conduction for PuO_{2-x} is 0.52 ev over a wide range of oxygen content, while the intrinsic activation energy for PuO_2 is 1.8 ev. (auth)

8806 (HW-75135) ZIRCALOY-2 TO CARBON STEEL EXPANDED JOINT N-REACTOR PROCESS TUBE FITTING. J. H. Fastabend (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 31, 1962. Contract [AT(45-1)-1350]. 24p.

The rolled joint met and surpassed all design and operating criteria under which it was evaluated. Bending loads concurrent with thermal cycling, thermal transient tests, and burst tests were conducted without separation of the joint. No leakage was detected on any of the properly formed joints tested under design conditions of 1,800 psi and 600°F. Tensile strength of the joint was determined to be 50% greater than design requirements. Relaxation tendencies of the joint were evaluated over a six-month thermal cycling period which showed a reduction in residual inner-face stress of approximately 1,000 psi. To obtain joint I. D. compatibility with fuel element passage, the rolls of the expander were modified for an optimum configuration. Studies of the effect of process water and decontamination solutions on the joint resulted in no problem envisioned from a corrosion aspect. Further testing of the rolled joint configuration will continue through the N-Reactor startup. This testing will view the operability of the joint on a long-term basis and further evaluate the residual stress picture. (auth)

8807 (HW-75267) CREEP PROPERTIES OF ZIRCALOY-2 FOR DESIGN APPLICATION. P. J. Pankaskie (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 10, 1962. Contract AT (45-1)-1350. 27p.

Long-term (circa 10,000 hours) creep data for constant load and temperature, and temperature and load cyclic conditions, have been obtained for Zircaloy-2 in the annealed and 15% cold worked conditions. In the annealed condition, creep behavior is substantially influenced by strain-age-hardening phenomena. In the 15% cold worked condition, creep behavior is very regular and predictable and for this reason should be employed in general design applications. (auth)

8808 (NAA-SR-7398) PULSE HEATING OF ZIRCONIUM–URANIUM HYDRIDES. R. E. Taylor, H. G. Weidberg' and R. T. Albee (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Dec. 30, 1962. Contract AT-11-1-GEN-8. 26p.

Apparatus and techniques for measuring power input, electric resistivity, temperature, and amount and rate of hydrogen released from Zr–U hydrides, ($ZrU_{0.84}H_{1.8\pm0.1}$) during transient conditions are described. Data are presented for six samples that were heated to their destruction. Initial heating rates were about 7500°C/sec; however, as H started evolving, the temperature approached an

equilibrium value of about 1200°C. Half of the samples survived until essentially all of their contained H was evolved. These samples received a total power input which corresponded to about a 130 Mw-sec excursion of a reactor containing 108 lb of fuel. (auth)

8809 (NP-12326) INVESTIGATION OF THE THERMAL PROPERTIES OF HIGH-TEMPERATURE INSULATION MATERIALS. Quarterly Progress Report No. 2. (Little (Arthur D.) Inc., Cambridge, Mass.). Nov. 15, 1962. Contract AF33(657)-9172. 81p.

A summary is included of the method of manufacture, physical, chemical and mechanical properties, and the cost and availability of prospective components for high-temperature insulation systems. Progress in the experimental and theoretical investigation of the contributions of solid conduction and radiation to thermal conductivity is discussed. Data on the effective thermal conductivity of graphite fibers are reported and an estimate of the precision of measurement is given. (R.J.S.)

8810 (NP-12451) EFFECT OF ELECTRON CONCENTRATION ON MECHANICAL PROPERTIES OF ALLOYS OF REFRACTORY METALS. Annual Topical Report. Ervin E. Underwood (Battelle Memorial Inst., Columbus, Ohio). Dec. 28, 1962. Contract Nonr-3589-(00). 48p.

Three methods were used to study segregation. Microhardness traverses across the microstructure have been used the most, giving a broad preliminary survey upon which to base more detailed studies in critical alloys. The hardness results have been supplemented by x-ray and autoradiography measurements. Later plans include detailed studies of Re segregation at individual boundaries by means of electron-probe microtraverses. Observation on twinning in Cr–Re and Mo–Re alloys is described. A quantitative analysis has been evolved for characterizing the density of twins induced around a conical hardness impression. The measured twin densities are correlated with composition, annealing temperature, and deformation temperature. In tensile and compressive tests the twinning characteristics, elongation, and the critical stress for twinning have been assessed. The volume changes associated with the formation of deformation twins in a Cr–35% Re alloy have also been determined. The appearance of deformation twins in thin films of these alloys has also been recorded and is useful in explaining the other results which have been obtained. A knowledge of the electrical behavior of alloys is exceedingly valuable in a study of their electronic properties. This program has as a goal the evaluation of such attributes as the contribution of the valence electrons of a solute atom to the solid solution, the atomic-bond strength, the directional coupling of the bond, the 3d shell participation, etc. These factors should then be related to the mechanical properties of the alloys, insofar as the essentially structure-insensitive electronic properties can be expected to govern the extremely structure-sensitive mechanical properties. Although attempts to relate structure-sensitive and -insensitive properties have been criticized, the search to demonstrate such a relationship nevertheless continues. A preliminary assessment of the electric resistance of Cr–Re and Mo–Re alloys, in various annealed states and over a range of temperatures, has been made. Attention was paid to the compositional variation of the Neél temperature in Cr–Re alloys and to superconductivity in a Mo–35 at.% Re alloy. The results are described. (R.J.S.)

8811 (NP-12481) MOLYBDENUM AND THE EFFECTS OF MINOR ADDITIONS OF YTTRIUM. Donald T. Klodt, C. Samuel Miller, and Joseph F. Nachman (Denver. Univ. Denver Research Inst.). [1962]. 17p.

The effects of additions of yttrium as a scavenger of the interstitial oxygen and grain-boundary oxides in molybdenum were studied. Continuously cast small-diameter molybdenum ingots were prepared by melting compacted powder charges of the base metals and yttrium hydride in a non-consumable electrode arc furnace under an argon atmosphere. The soundness and structure of the ingots were improved when the argon pressure was reduced to approximately 50 mm Hg. The ingots were machined to remove surface imperfections and then swaged into rods from which impact specimens were prepared. A recrystallization study was conducted, and all specimens were given a 1-hr recrystallization anneal prior to final machining. Impact tests were made over a range of temperatures and the ductile-to-brittle transition temperature determined. The ductile-to-brittle transition temperature of a 99.2 wt % Mo–0.8 wt % Y alloy was lowered by approximately 200°C compared to the unalloyed molybdenum prepared by the same techniques. Retention of yttrium in the molybdenum after arc melting was of the order of 5% of the amount added. (auth)

8812 (RT/MET(62)4) TRANSFORMATION OF METASTABLE PHASES IN THE 2, 3 AND 5 AT % URANIUM–MOLYBDENUM ALLOYS. C. Fizzotti (Italy. Comitato Nazionale per l'Energia Nucleare. Divisione Materiali, Rome). Sept. 1962. 31p.

Metastable phases appearing in some uranium alloys containing molybdenum quenched from high temperature were characterized. Two types of metastable phases obtained in 2, 3, and 5 at.% molybdenum were called respectively α_2' and α_5'. The thermal decomposition of these two phases in the temperature range from 600 to 400°C was followed both by metallography and by measurement of macrohardness and lattice parameters. (auth)

8813 (SCTM-224-62(11)) INVESTIGATION OF SOLID SOLUTIONS IN THE ANTIFERROELECTRIC REGION OF THE $PbHfO_3$–$PbTiO_3$–$PbSnO_3$–$PbNb_2O_6$ SYSTEM. R. H. Dungan and A. H. Stark (Sandia Corp., Albuquerque, N. Mex.). Nov. 1962. Contract [AT(29-1)-789]. 39p.

Dielectric, piezoelectric, and ferroelectric properties were investigated on compositions in the high hafnate region of the $PbHfO_3$-$PbTiO_3$-$PbSnO_3$-$PbNb_2O_6$ system. Temperature-composition phase diagrams were prepared depicting the phase relationships in this system. These phase relationships are quite complex. At least five phases exist in the portion of the system investigated—two ferroelectric phases, two antiferroelectric phases, and one paraelectric phase. Antiferroelectric compositions were prepared which could be field-enforced into the ferroelectric state over a temperature range from 20 to 100°C. Spontaneous and remanent polarizations were of the same order as observed for $PbHfO_3$ base materials, i.e., approximately 25 $\mu coul/cm^2$ for the better compositions. (auth)

8814 (TID-17530) MATERIALS FOR HIGH TEMPERATURE NUCLEAR ENGINEERING APPLICATIONS. Quarterly Report No. 2, July 1 to October 1, 1962. J. D. Fleming, J. W. Johnson, Paul Boland, S. H. Bomar, A. R. Colcord (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). Contract AT(40-1)-2483. 44p.

More detailed studies were made of the effects of steam on the firing behavior of slip-cast fused silica. The results of this firing profile study were highly erratic and indicated that the tube furnace was not suitable for steam

firing. Determination of the compressive strength of slip-cast fused silica was completed. The maximum compressive strength ranged from 21,000 psi at a firing temperature of 2100°F to 29,500 psi at 2300°F. The bulk density changes in slip-cast fused silica were expressed mathematically. An analysis indicated that the activation energy for sintering of slip-cast fused silica is 68.6 kcal per mole. A statistical study was made of the effects of 0.1 and 1 wt % additions of Baymal on the ignition characteristics of 14.6 wt % Al–U_3O_8 composites. The effects of U_3O_8 particle size were studied in 25 wt % Al–U_3O_8 composites. Only the –325 mesh U_3O_8 showed significantly different ignition characteristics, yielding decreased ignition temperatures and increased differential thermal analysis peak areas. One differential thermal analysis furnace was converted to chromel–alumel thermocouples to give increased sensitivity. Fifty wt % Al–U_3O_8 composites were pressed using "dead-burned" U_3O_8, and differential thermal analysis was applied to the pellets using various standards. (R.J.S.)

8815 (TID-17546) STATISTICAL THERMODYNAMICS OF METALLIC SOLUTIONS. Annual Progress Report, January 31, 1962 to January 31, 1963. L. P. Skolnick (Delaware. Univ., Newark). Dec. 18, 1962. Contract AT(30-1)-2722. 19p.

The system Cu–Au–Ag has been studied intensively in order to test any models suggested by theoretical work, and to indicate other possible theoretical approaches. The system was chosen for its relative simplicity both theoretically and experimentally and because a fair amount of data for the elements and the binary systems already exist. Some of the problems and possibilities in the use of statistical analysis of thermodynamic data are outlined. (R.J.S.)

8816 (UCRL-10426) THE LOW-TEMPERATURE HEAT CAPACITY OF TIN AND INDIUM (thesis). Harry Roger O'Neal (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 1963. Contract W-7405-eng-48. 69p.

The heat capacity of In was measured from 0.08 to 4.2°K, and that of Sn from 0.09 to 1.2°K. The results on In show that below about 0.7°K the total superconducting-state heat capacity is less than the normal-state lattice heat capacity alone. This result is surprising compared with analyses of the heat capacity data of a superconductor made in the usual way. However, the effect was not observed in Sn. Comparisons with other pertinent experiments are made, and two proposed explanations of the effect are discussed. (auth)

8817 (UCRL-10468) MECHANICAL BEHAVIOR OF SINGLE AND POLYCRYSTALLINE CESIUM BROMIDE (thesis). Lawrence D. Johnson (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 12, 1962. Contract W-7405-eng-48. 95p.

Plastic-deformation experiments were conducted on cesium bromide, a material that lacks cleavage planes, to study the effect of the absence of cleavage on the mechanical behavior. Observations were made and theories were proposed concerning the mechanisms of plastic deformation and fracture in cesium bromide. Single-crystal cesium bromide was found to be soft and ductile if it was favorably oriented relative to the loading axis to activate the {110} {100} slip systems. Kink bands were formed by directing a compression load normal to the {100} system of planes. Cross-slip was found to occur during deformation at all test temperatures. Tensile and bending loads directed normal to {100} and {110} planes caused fracture on {110} planes, while compressive loads normal to {100} planes forced fracture on {112} planes rather than {110} planes. The ductility of polycrystalline cesium bromide was found to decrease for samples with smaller grain sizes. The absence of a sufficient number of slip systems in the specimens may have been responsible for this plastic behavior. The mechanism of fracture was intergranular in polycrystalline cesium bromide. (auth)

8818 (UCRL-13052) THE FRICTIONAL CHARACTERISTICS OF VARIOUS ALLOYS AND COATINGS AT ELEVATED TEMPERATURES. Report to Lawrence Radiation Laboratory. Herman L. Lessley and Clifford L. Dotson (Southern Research Inst., Birmingham, Ala.). Sept. 21, 1962. Contract [W-7405-eng-48]. 187p.

The reciprocating frictional characteristics of various combinations of three Ni-base alloys, two ceramic materials, and 26 coating materials were determined at different temperatures ranging from room temperature to 1400°F for periods of one hour. The length of stroke (0.5 in.) and reciprocating frequency (8.8 cpm) were constant throughout the program. Among the coated materials, there was no consistent effect of temperature on the coefficient of friction. For the ceramic materials the coefficient tended to increase with increasing temperature, and for the uncoated metals the coefficient of friction tended to remain constant or to decrease with increasing temperature. In the René 41, for example, the average dynamic coefficient of friction decreased from about 0.60 at room temperature to about 0.30 at 1400°F. The effects on coefficient of friction of variations in contact pressure from 15 to 3620 psi, which were studied in conjunction with René 41 specimens only, were negligible. (auth)

8819 (UCRL-13057) INVESTIGATIONS OF TITANATE CERAMICS FOR VOLTAGE GENERATION UNDER HIGH IMPACT LOADING. Final Report, September 1958–December 1959. (Electro Ceramics Inc., Salt Lake City). For California. Univ., Livermore. Lawrence Radiation Lab. Contract [W-7405-eng-48]. 151p.

Commercial grades of basic powders, e.g., $BaTiO_3$, $CaTiO_3$, $PbTiO_3$, presently available in large lot production permit the processing of dependable ceramic elements. Very high purity powders are not recommended because of their scarcity and more critical sintering conditions. Titanate ceramic production techniques adapted to the economical manufacture of large quantities of ceramic elements when coupled with accurate machine finishing operations, e.g., lapping, grinding and sawing, are adequate to assure the fabrication of reproducible, close-tolerance pieces. A preferred method of manufacturing ceramic plates of limited cross section would include the use of spray drying, dry pressing, and precision machining. Recognizing that geometrical shape factors can influence variations in significant properties of polarized ceramics, it is feasible to produce relatively large quantities of elements suitable for high voltage generation devices and having limited variations regarding density, frequency constant, dielectric constant, and coupling coefficient. A list of properties, which would provide reliable data for the selection of preferred ceramic samples for high voltage generation, includes the following: density of sintered samples; capacitance and dissipation factor; dielectric strength; frequency constant; electromechanical coupling coefficient or the related effective piezoelectric strain constant; relative coercive field; and the variation of elastic, dielectric, and piezoelectric behavior as a function of temperature. A "preferred" ceramic element for high voltage generation under impact loading will have a high ratio of coupling coef-

ficient to the square root of the dielectric constant, a high coercive field, and low mechanical and dielectric losses under high a-c fields. An example of a titanate composition, which combines all of the features of low internal losses with high coercive field and high voltage sensitivity together with an extended useful temperature range, is one of 84% $BaTiO_3$ + 8% $CaTiO_3$ + 8% $PbTiO_3$. (R.J.S.)

8820 (XDCL-60-8-40) HIGH TEMPERATURE CLADDING ALLOYS. John F. Collins and James A. McGurty (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Aug. 8, 1960. Contract [AT(11-1)-171]. 37p.

For high-temperature applications, fuel element cladding materials are required to protect the base metal structure and to contain the fuel so as to minimize fission product release and fuel loss. Since the early work on clad Mo fuel element concepts, many metallic cladding systems have been investigated for direct cycle reactors. The developments in stainless steel and Ni alloy claddings are reviewed and the more recent applications of new oxidation-resistant ferrous-base and chromium-base alloys as claddings for refractory metals are presented. (auth)

8821 (EURAEC-450) NON-DESTRUCTIVE WELDING RESEARCH. Quarterly Report No. 5, July 1, 1962 to September 30, 1962. (Röntgen Technische Dienst N. V., Rotterdam). Work Performed under United States–Euratom Joint Research and Development Program. Contract 045-61-5RDH. 37p. A translation.

A total of 32 radiographs was made of two steel plate specimens, 120-mm and 150-mm thick, using a 17-Mev betatron. Details of the procedures and equipment are set forth. Particulars are given of the weld preparation in two plates 50-mm thick which are to be examined ultrasonically. (R.J.S.)

8822 (EURAEC-457) THE DIFFUSION OF INERT GASES IN SOLID BODIES. Quarterly Report No. 5, July 1, 1962 to September 30, 1962. (Hahn-Meitner-Institut für Kernforschung, Berlin). Work Performed under United States–Euratom Joint Research and Development Program. Contract 064-61-8-RDD. 4p. A translation.

The diffusion of argon in potassium chloride and potassium bromide is briefly discussed. The diffusion of xenon in uranium dioxide, uranium carbide, and thorium dioxide is also briefly reported. (R.J.S.)

8823 (UCRL-Trans-882(L)) GROWTH AND MORPHOLOGY OF AlN SINGLE CRYSTALS. W. Kleber and H. D. Witzke. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore) from Z. Krist., 116: 126-33(1961). 1962. 10p.

Single crystals of AlN were grown in a cylindrical C furnace according to the reaction $Al_2O_3 + 3C + N_2 \rightleftharpoons 2AlN + 3CO$. Both colorless and blue prismatic crystals as well as whiskers of AlN were formed. The morphological development of the synthetic crystals is discussed from a structural point of view. (auth)

8824 THE CRYSTAL STRUCTURE OF Ru_3Be_{17}. Donald E. Sands, Quintin C. Johnson, Oscar H. Krikorian, and Kurt L. Kromholtz (Univ. of California, Livermore). Acta Cryst., 15: 1191-5(Dec. 10, 1962).

Ru_3Be_{17} is body-centered cubic with a = 11.337 Å; there are eight formula units in the unit cell and the space group is Im3. A feature of the structure which is unusual for an intermetallic beryllide is the occurrence of a hole of radius 2.81 Å around the origin of the unit cell. Powder patterns show a corresponding isostructural osmium beryllide with a = 11.342 Å. (auth)

8825 THE CRYSTAL STRUCTURE OF $Ce_{24}Co_{11}$. Allen C. Larson and Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). Acta Cryst., 15: 1224-7(Dec. 10, 1962).

The structure of $Ce_{24}Co_{11}$, the most Ce-rich compound in the Ce–Co system, has been determined by single crystal x-ray methods. The compound is hexagonal, space group $P6_3mc$ with a = 9.587 and c = 21.825 Å, Z = 2. The structure was solved by applying Buerger's minimum function. Nearly all of the Ce atoms have rather close Co neighbors, some Ce–Co distances being as short as 2.61 Å. (auth)

8826 THE CRYSTAL STRUCTURE OF ThPt AND SOME RELATED COMPOUNDS. Jean R. Thompson (Imperial Coll. of Science on Tech., London). Acta Cryst., 15: 1308-9(Dec. 10, 1962).

The crystal structures of several thorium alloys, including ThPt and ThRh, are reported. The alloys were prepared by arc-melting the component metals in a Zr-gettered atmosphere. Powders were prepared by crushing in air. Powder patterns were obtained with a Guinier-type focusing camera using monochromatized Cu radiation, and the line intensities were estimated visually. (R.J.S.)

8827 EFFECTS OF A MAGNETIC FIELD ON THE THERMOELECTRIC PROPERTIES OF A BISMUTH–ANTIMONY ALLOY. R. Wolfe and G. E. Smith (Bell Telephone Labs., Inc., Murray Hill, N. J.). Appl. Phys. Letters, 1: 5-7(Sept. 1962).

The thermoelectric properties of an alloy of 88 at. % bismuth and 12 at. % antimony in transverse magnetic fields up to 17,000 Oe are reported. Graphs of variation of resistivity with magnetic field strength and of variation of thermoelectric figure of merit with temperature show that resistivity rises with field strength. Magnetothermoelectric results with pure bismuth are similar to those for this alloy. (D.C.W.)

8828 THE SOLID SOLUBILITY OF NICKEL IN SILICON DETERMINED BY NEUTRON ACTIVATION ANALYSIS. J. H. Aalberts and M. L. Verheijke (N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Appl. Phys. Letters, 1: 19-20(Sept. 1962).

Difficult determination of the solubility of nickel in silicon is made by neutron activation analysis. Discs of p-type silicon are plated with nickel and irradiated. Activity of the $Ni^{58}(n,p)Co^{58}$ product is analyzed, showing that nickel and copper have solubility of the same order of magnitude in silicon. (D.C.W.)

8829 MAGNETIC PROPERTIES OF SOME URANIUM NITRIDES AND CARBIDES. W. Trzebiatowski, R. Troć, and J. Leciejewicz (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw and Department of Inorganic Chemistry, Technical Univ., Warsaw). Bull. Acad. Polon. Sci., Ser. Sci. Chim., 10: 395-8(1962). (In English)

The magnetic susceptibilities of uranium carbides and nitrides were determined by means of the Faraday method between liquid air and room temperatures using a microbalance. The magnetic properties of uranium carbides are quite different from those of uranium nitrides. The magnetic susceptibilities are rather low, that of UC_2 is practically temperature independent and that of UC shows a slight increase with temperature. The magnetic properties resemble those of metallic uranium or other transitional metals. A metallic bond may be expected for carbides rather than nitrides, because nitrogen, which is more electronegative than carbon, favors the ionic bond. (P.C.H.)

8830 THE MAGNETIC PROPERTIES OF URANIUM SELENIDE (USe). W. Trzebiatowski and W. Suski (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw and Department of Inorganic Chemistry, Technical Univ., Warsaw). Bull. Acad. Polon. Sci., Ser. Sci. Chim., 10: 399-400(1962). (In English)

Pure uranium selenide (USe) was found to have a Curie point of 185–190°K. The g-susceptibility of $USe_{1.0}$ at 290°K was 24.1×10^{-6}. Samples containing less than 50 at. % selenium represented mixtures of the paramagnetic uranium metal with the ferromagnetic uranium monoselenide, the Curie temperature of which did not vary. The magnetization of USe at 84°K reached a value of 22.2. From values of σ measured with a field strength of 14,300 Oe at 84°K, 100°K (σ = 22.03) and 122°K (σ = 21.5), the value σ_0 = 23.1 may be deduced according to the $T^{3/2}$ function. The magnetic moment was calculated to be 1.31 BM. (P.C.H.)

8831 DISINTEGRATION OF NICKEL HYDRIDE UNDER HIGH PRESSURE. B. Baranowski (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw). Bull. Acad. Polon. Sci., Ser. Sci. Chim., 10: 451-5(1962). (In English)

The disintegration of nickel hydride under its own hydrogen pressure was performed in the pressure range of 30–2100 atm. No indication of approaching equilibrium between gaseous hydrogen and nickel hydride was observed. Up to a pressure of 4000 atm desorption occurred as quickly as under the pressure of 1 atm. But under the pressure of 19,000 and 25,000 atm the hydrogen content remained practically unchanged. In this pressure range desorption ceased completely or it occurred with a velocity below the accuracy of measurement. It is suggested that within the pressure range, where a considerable decrease of the desorption rate occurs, equilibrium establishes between gaseous hydrogen and nickel hydride. The desorption rate constant of nickel hydride may also be a function of pressure. (P.C.H.)

8832 COMBUSTION IN AIR OF MAGNESIUM-CANNED CARTRIDGES. D. Martin, J. Bauzit, R. Cante, and L. Hebrard. Bull. Inform. Sci. Tech. (Paris), No. 63, 76-82(July 1962). (In French)

In a reactor of average specific power cooled by air at atmospheric pressure, the combustion of a cartridge through an accidental and local failure in the cooling is a possibility. It is known that such an accident occurred in G1 in October 1956, but recent analysis of the remains of the destroyed cartridge has furnished some new information; in particular, it establishes a comparison between the relative importance of the accident in the channel and the slight repercussions recorded outside. Relevant photographs show the deterioration of the rods and testify that the point of fusion has exceeded a certain length; over the rest of the cartridge it can be seen that the canning has burned away completely, only attacking the uranium superficially. In addition, laboratory tests have been carried out in a small experimental channel on magnesium-canned cartridge elements. From these tests it has been possible to determine the inflammation temperatures and the conditions under which combustions of canning and uranium can develop in air under different draught conditions. (auth)

8833 ELECTRON SPIN RESONANCE OF AN X-RAY IRRADIATED SINGLE CRYSTAL OF DIKETOPIPERAZINE. W. C. Lin and C. A. McDowell (Univ. of British Columbia, Vancouver). Can. J. Chem., 41: 9-13(Jan. 1963).

The electron spin resonance of an x irradiated single crystal of diketopiperazine was measured at 9 Gc/sec for various orientations of the crystal in the static magnetic field. From an analysis of the hyperfine structure observed, the components of the hyperfine interaction tensor for the radical produced by the irradiation were calculated. The principal values for the hyperfine interaction tensor were similar to those found for the radical produced by the x or γ irradiation of glycylglycine and N-acetylglycine and are therefore attributed to a radical with a C–H fragment. The fine details of the spectrum indicate that the radical responsible for the electron resonance observed probably is formed from diketopiperazine by the loss of a hydrogen atom from one of the CH_2 groups in that molecule. (auth)

8834 EFFECTS OF OXYGEN AND HYDROGEN ON THE FLOW AND FRACTURE CHARACTERISTICS OF COLUMBIUM AND TANTALUM. H. R. Ogden, A. G. Imgram, and E. S. Bartlett (Battelle Memorial Inst., Columbus). Can. Met. Quart., 1: 13-28(July-Sept. 1962).

Oxygen and hydrogen have detrimental effects on the ductility of niobium and tantalum, particularly at subzero temperatures. Tantalum has a lower tolerance for oxygen than does niobium; however, the ductility of niobium containing oxygen is more temperature-sensitive than tantalum. Fracture modes change from shear to cleavage with increasing oxygen content in tantalum with only a minor effect of decreasing temperature. In niobium, the fracture change from shear to cleavage is much more dependent on temperature. Small hydrogen additions have a very deleterious effect on flow and fracture. It appears that hydrogen reduces the capability of niobium and tantalum for localized deformation. Failure is predominately by cleavage in samples containing hydrogen tested at room temperature and below. At elevated temperatures, however, hydrogen additions appear to be innocuous. (auth)

8835 THE ELECTRODE POTENTIALS OF RADIOACTIVE SAMPLES OF "ARMCO" STEEL AND OF LOW-CARBON STEEL IN DISTILLED WATER AND IN AQUEOUS SOLUTIONS OF VARIOUS INHIBITORS. K. N. Yandushkin, S. A. Balezin, and Vikt. I. Spitsyn (Inst. of Physical Chemistry, Academy of Sciences, USSR and Moscow State Teaching Inst.). Dokl. Akad. Nauk SSSR, 147: 155-8(Nov. 1, 1962). (In Russian)

Samples of Armco steel and low-carbon steel were irradiated at a flux of 0.87×10^{13} n/cm^2/sec. The specific activity of Fe^{59} in the sample was 0.5 mc/g or 5 mc per sample. The electrode potential of the sample was measured at 25°C against a reference calomet half-cell at 10 and 30 seconds, 1, 5, 10, and 30 minutes, 1, 2, 3, 6, 10, and 18 hours, and 1, 2, 3, and 4 days in 100 ml of solution. The potential E of the radioactive samples was plotted versus lg t and was significantly more negative than the potential of the control samples. The difference in potential between the radioactive and control samples was 50 to 200 mv for Armco steel and 40 to 175 mv for carbon steel. This difference became smaller with time. The addition of $NaNO_2$ and C_6H_5COONa as inhibitors slows down the corrosion process, but significantly more inhibitor is required for the radioactive samples than for the control samples. (TTT)

8836 THE HYDROTHERMAL SYNTHESIS AND X-RAY STUDY OF COMPOUNDS OF THE TYPE $ReNbTiO_6$ (Re = A RARE EARTH). A. I. Komkov, M. P. Belopol'skii, S. G. Chernoruk, and D. A. Kolpakov (All-Union Geological Research Inst., USSR). Dokl. Akad. Nauk SSSR, 147: 687-8 (Nov. 21, 1962). (In Russian)

In preparing compounds of the type $ReNbTiO_6$, stoichiometric amounts of TiO_2, Nb_2O_5, and Re_2O_3 (Re = a rare earth) were fused with potassium pyrosulfate, and the mixed hydroxides were precipitated with ammonia. In synthesizing the $ReNbTiO_6$ compounds with a rare earth atomic

number from 57 to 68, the mixed hydroxides were autoclaved in a stainless steel vessel at a temperature of 300°C and a pressure of 87.6 kg/cm^2. With rare earths having atomic numbers from 69 to 71, the temperature was 250°C, and the pressure was 40.6 kg/cm^2. The mixture was autoclaved 5 to 10 hours. X-ray analysis showed that the structures of the $ReNbTiO_6$ compounds were equivalent to the structure of $CeNbTiO_6$ which is prepared by sintering $2CeO_2$, Nb_2O_5, and $2TiO_2$ at high temperatures. These compounds all belong to the spacial group D_{2h}^{16} = P6 mm, and have 4 $ReNbTiO_6$ units in the elementary cell. There is a regular decrease in the dimensions of the elementary cell from $LaNbTiO_6$ to $LuNbTiO_6$ due to the decrease in ionic radius in going from La^{3+} to Lu^{3+}. (TTT)

8837 EFFECT OF PRESSURE ON MONOCLINIC-TETRAGONAL TRANSITION OF ZIRCONIA; THERMODYNAMICS. E. Dow Whitney (Carborundum Co., Niagara Falls, N. Y.). J. Am. Ceram. Soc., 45: 612-13(Dec. 1962).

The pressure-temperature equilibrium curve for the monoclinic-tetragonal transformation at ~1200°C in zirconia was calculated. (R.J.S.)

8838 INCONSISTENCIES IN ZIRCONIA LITERATURE. Berthold C. Weber (Aeronautical Research Labs., Wright-Patterson AFB, Ohio). J. Am. Ceram. Soc., 45: 614-5 (Dec. 1962).

Erroneous statements appear in the literature and are briefly discussed. Much of the misinformation concerns the crystal structure of zirconium dioxide, impure samples in some cases having been used by investigators. (R.J.S.)

8839 STABILITY OF $Ca_2Be_3O_5$ IN THE SYSTEM BeO–CaO. R. A. Potter and L. A. Harris (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc., 45: 615-16(Dec. 1962).

A reinvestigation of the phase equilibria for the system BeO–CaO was undertaken in an attempt to clarify previously conflicting data and to determine the conditions for the formation of $Ca_2Be_3O_5$. (R.J.S.)

8840 ELECTRICAL RESISTIVITY OF SCANDIUM. R. V. Colvin and Sigurds Arajs (U. S. Steel Corp. Research Center, Monroeville, Penna.). J. Appl. Phys., 34: 286-90 (Feb. 1963).

Electrical resistivity of polycrystalline scandium has been studied between 1.38 and 358.8°K. The measurements show a step-type anomaly in the resistivity between 4 and 5°K and possibly a very small minimum at 9.5°K. Considerable hysteresis in the electrical resistivity exists at low temperatures, depending upon the previous thermal history of the sample. It is very likely that these anomalies may be associated with a superconductive substructure resulting from the presence of small amounts of tantalum as an impurity. However, the possibility that the anomalous behavior is due to the occurrence of some cooperative magnetic states at low temperatures cannot be completely eliminated at the present time. Between about 80 and 360°K the intrinsic resistivity of scandium is describable by the Bloch-Grüneisen formula with Debye θ of 275°K. At lower temperatures the temperature dependence of the intrinsic resistivity is consistent with expectations derived from the interband electron-phonon scattering. Ziman's reduced electrical resistivity at 300°K is calculated to be 50.8. (auth)

8841 ELASTIC-PLASTIC PROPERTIES OF IRON. John W. Taylor and Melvin H. Rice (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys., 34: 364-71(Feb. 1963). (LADC-5433)

Smooth bore cannons were used to produce plane collisions between plates of Armco iron. Projectile velocities ranged from 60 to 400 m/sec. Time resolved measurements of the target free-surface velocities indicate that the dynamic yielding process is time dependent on a submicrosecond time scale. The shape of the Hugoniot curve in the pressure-volume plane up to 80 kbars shows that true hydrostatic equilibrium has not yet been established behind the elastic wave. On the other hand the substantially constant free-surface velocities behind the plastic front indicate that the material cannot be far from equilibrium after a short time. Some data on the rarefaction sound speed in the high pressure region are interpreted to imply a value very near 6 km/sec. (auth)

8842 THERMAL EXPANSION OF CERIUM DIOXIDE BY X-RAY DIFFRACTION METHOD. P. C. Mahanta, J. Hatibarua, and R. K. Das (Gauhati Univ., India). J. Sci. Ind. Res. (India), 21B: 596-7(1962).

The linear coefficient of thermal expansion of "specpure" cerium dioxide was determined by the x-ray powder photographic method for the temperature range 31–1028°C. Over this range of temperature, the coefficient of expansion increases uniformly and no structural change could be detected. (auth)

8843 COMPATIBILITY OF METALLIC FUELS WITH CLADDING MATERIALS. (SUMMARY REPORT). H. E. Roellig (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 5: 641-68(Sept. 1962). (In German)

A survey was made on the compatibility of metallic U, Pu, and Th with Al, Zr, Mg, Be, steel, the metals of the iron group, and the high-melting metals (W, Mo, V, Nb, and Ta). The methods used for study and resulting evaluation were introduced. The results obtained by various authors (diffusion and penetration coefficients, activation energies, etc.) were compared and discussed. (tr-auth)

8844 COMPARISON OF THE BEHAVIOR OF THERMAL CYCLING OF THE α-PHASE OF URANIUM SINTERED BY EXTRUSION AND OF MASSIVE URANIUM. José Peix and Georges Cizeron (Centre de Recherches Metallurgiques de l'École des Mines, Paris). Mem. Sci. Rev. Met., 59: 769-83(Nov. 1962). (In French)

Massive unalloyed U worked by conventional methods changes considerably when subjected to systematic thermal cycling. Tests were therefore carried out to determine whether a better behavior on thermal cycling was shown by U-rich materials with a disperse U oxide phase, which were produced by extrusion sintering of slightly oxidized powder of calciothermal origin. Extruded bars of α or β phases were used in this work either in the as-extruded or in the heat-treated conditions. The study of the dimensional changes which occur in cycled specimens was supplemented by other methods was to confirm or enlarge the results obtained, e.g., by micrograph analysis, dilatometric observations, or changes in density. The conclusion derived from this work was that these new materials were more satisfactory on thermal cycling than conventional unalloyed U. (auth)

8845 PHYSICAL HYDROGEN EMBRITTLEMENT OF STEEL AT ELEVATED TEMPERATURES. G. H. Broomfield (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature, 196: 824-5(Dec. 1, 1962).

Tests were conducted to determine the temperature dependence of hydrogen embrittlement in a low alloy pressure vessel steel. The steel used had nominally 1% Cr, 0.5% Mo, and 0.1% C. The forged specimens were tested after holding for 4 hr at the test temperature in air at atmospheric pressure or in hydrogen at 1,750 lb/sq in. g. A second batch of specimens was held for 4 hr at 250°C

in hydrogen or argon at 1,750 lb/in.^{4} g before testing under pressure at 250°C or below. Data are plotted. The diffusible hydrogen taken up by the forged steel specimens at 1,750 lb/in.^{2} g and 250°C was approximately 1.4 cc per 100 g steel. These preliminary results show that hydrogen has a significant effect on the true breaking stress of this steel at temperatures up to 250°C. (C.H.)

8846 TRANSFORMATION KINETICS AND HEAT TREATMENT OF U–Cr ALLOYS. Kō Soeno (Hitochi Ltd., Tokyo). Nippon Genshiryoku Gakkaishi, 4: 789-96(Nov. 1962). (In Japanese)

The kinetics of the β-to-α transformation in nucleation and growth mechanism, and the effect of the conditions of heat treatment on grain size, were studied on alloys containing from 0.25 to 1.0 at. % Cr. Nearly constant activation energies, which vary from 32 to 38 kcal/g-atom with the content of alloying element, correspond to the temperature regions below the noses of T-T-T diagrams. And more effect of isothermal transformation temperature on grain size was observed in the temperature region above the nose of T-T-T diagram than below, but the effect of the content of alloying element is not conspicuous in whole temperature region, so far as nucleation and growth mechanism is concerned. As grain size is, in general, discontinuously increased by martensitic transformation, the lower limit of temperature which produces fine structure in isothermal transformation is correspondence to the upper limit of the beginning of martensitic transformation. Ms (β-to-α) temperatures are determined with alloys containing from 0.25 to 1.0 at. % Cr. (auth)

8847 THE OPTICAL PROPERTIES AND STRUCTURE OF ZIRCONIUM DIOXIDE FILMS. A. I. Sviridova. Opt. Spectr. (USSR) (English Transl.), 13: 236-8(Sept. 1962).

Data are presented on the optical properties and structure of zirconium dioxide films subjected to temperature treatment. (auth)

8848 SOME PROPERTIES OF PURE POLYCRYSTALLINE BORON. T. Niemyski and W. Zawadzki (Inst. of Physics, Polish Academy of Sciences, Warsaw). Phys. Letters, 2: 30-1(Aug. 1, 1962). (In English)

The phase-diagram of the boron-platinum alloy system was investigated and the melting point of the eutectic composition (about 35% boron) determined as 750 ± 10°C. The electrical conductivity of seven polycrystalline boron samples was measured from 20 to 750°C, and the activation energies were determined. The thermoelectric power of several polycrystalline boron samples is given as a function of temperature. (H.D.R.)

8849 MAGNETO-ACOUSTIC OSCILLATIONS IN THALLIUM. J. A. Rayne (Westinghouse Research Labs., Pittsburgh). Phys. Letters, 2: 128-9(Sept. 1, 1962). (In English)

Longitudinal sound wave transmission measurements were made at frequencies up to 270 Mc/s in a single crystal of thallium. The resulting dimensions of the Fermi surface are compared with the predictions of the free electron model. The agreement is very good if a single zone scheme is used, demonstrating the importance of spin-orbit effects on the band structure of metals having high atomic number. (H.D.R.)

8850 RECOVERY OF COLD-WORKED ALUMINUM AT LOW TEMPERATURES. T. S. Hutchison and S. L. McBride (Royal Military Coll. of Canada, Kingston). Phys. Letters, 2: 157-9(Sept. 1, 1962). (In English)

The attenuation of high-frequency sound was measured in single crystals of superpure and zone refined aluminum to study the nature of point defects. Separate attenuation curves were obtained for the temperature range 4.2 to 90°K for specimens subjected to a cooling rate effect, cold work effect, and temperature cycling effect. A sharp rise in the attenuation at 50°K is associated with a decrease in the number of point defects, and the formation of the defects is attributed to plastic deformation at low temperatures. (H.D.R.)

8851 THERMAL EXPANSION OF PYROLYTIC GRAPHITE. F. Entwisle (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). Phys. Letters, 2: 236-8(Oct. 1, 1962). (In English)

Thermal expansion coefficients over the ranges −196 to 20°C, 20 to 120°C, and 100 to 700°C have been measured for specimens of pyrolytic graphite. The curves of fractional change in length against temperature and corresponding expansion coefficients (α_1) at 50°C intervals for the range 20 to 700°C in both the a and c single crystal directions are shown. These curves are compared with the dimensional changes observed by Nelson and Riley on single crystals and with Riley's theoretically derived α_1 against temperature curves and found to be very similar. (H.D.R.)

8852 HALL COEFFICIENTS OF LIQUID METALS. A. J. Greenfield (Univ. of Chicago). Phys. Letters, 3: 121-2(Dec. 15, 1962). (In English)

A very accurate experimental technique is described for the measurement of the Hall coefficients of liquid metals. Measurements having an error factor of 4 less than that of previous work have been made on Hg, In, Tl, and Pb. For Hg and In, the measured Hall coefficient is equal to the free electron value, or the value obtained from an electron concentration equal to the atomic concentration times the valency, 2 for Hg and 3 for In. For Tl and Pb, the measured Hall coefficient is about 18 and 32% smaller than the respective free electron values, corresponding to a valency of 3 for Tl and 4 for Pb. (H.D.R.)

8853 SUPERCONDUCTIVITY OF $NbSn_2$. D. J. Van Ooijen, J. H. N. Van Vucht, and W. F. Druyvesteyn (Philips Gloeilampenfabrieken, Eindhoven, Netherlands). Phys. Letters, 3: 128-9(Dec. 15, 1962). (In English)

In the course of investigations on the Nb_3Sn phase diagram, a new superconductive intermetallic compound was found with the composition $NbSn_2$ and having a critical temperature of 2.60°K. A short description is given of the preparation of $NbSn_2$, and the results of measurements of the resistance transition and critical field are presented. (H.D.R.)

8854 EFFECT OF NON-METALLIC ATOMS ON THE ELECTRICAL PROPERTIES OF REFRACTORY COMPOUNDS OF TRANSITION METALS. S. N. Lvov, V. F. Nemchenko, and G. V. Samsonov (Kherson State Pedagogical Inst. and Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 4, 3-10(July-Aug. 1962). (In Russian)

Data on the electrophysical properties of borides, carbides, and nitrides of Hf, Ti, Zr, U, Nb, Ta, Cr, Mo, and W are generalized. The principal regularities of the changes in the properties with a change in the acceptor capacity of d-electron shells of the atoms of transient metals and the ionizing potentials of the non-metals are pointed out. (auth)

8855 PROSPECTS OF UTILIZING REFRACTORY COMPOUNDS FOR HIGH-TEMPERATURE THERMOCOUPLES. P. S. Kislyi (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Porosh-

kovaya Met., Akad. Nauk Ukr. SSR, No. 4, 50-5(July-Aug. 1962). (In Russian)

The prospects of utilizing refractory compounds as thermoelectrode material are presented. Some questions concerning the manufacture of thermoelectrodes of homogeneous length from refractory compounds are discussed. On the basis of an analysis of the stability of the thermoelectric characteristics and resistance of refractory compounds in some aggressive media (air, Co, CO + N_2, fused metals), it was concluded that it is possible to manufacture high-temperature thermocouples from refractory compounds with one graduating characteristic for a set of material. (auth)

8856 ELECTRICAL RESISTANCE OF REFRACTORY COMPOUNDS AT HIGH TEMPERATURES. G. V. Samsonov and V. S. Sinelnikova (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 4, 59-62(July-Aug. 1962). (In Russian)

The temperature dependence of the electrical resistance of carbides of titanium, zirconium, hafnium, niobium, molybdenum, tungsten and borides of titanium and zirconium was measured. The thermal coefficients of the electrical resistance were calculated for the measured carbides and borides. Attempts were made to correlate the values of the electrical resistances with the electron structure of the compounds. (auth)

8857 THE NICKEL CORNER OF THE TERNARY SYSTEMS Ni–Sn–B. Hans H. Stadelmaier and Leon T. Jordan (North Carolina State Coll., Raleigh). Z. Metallk., 53: 719-21(Nov. 1962). (In German)

The liquidus projection and an isothermal section at 800°C was determined in the nickel rich corner of the system nickel–tin–boron. This portion of the system is dominated by a congruently melting ternary boride $Ni_{21}Sn_2B_6$ with a $D8_4$ type structure. The homogeneity range of the ternary phase extends to both sides of the ideal composition and runs from 17.5 to 27.5 at. % boron. On the other hand, the tin content varies little and has a maximum at 800°C of 6.8 at. %. The lattice parameter increases with tin and boron content. It has a maximum value of 10.59 Å and a minimum value of 10.58 Å. (auth)

8858 INVESTIGATION ON WIRES OF SUPERCONDUCTING ALLOY OF THE SYSTEMS Nb–Ti AND Nb–Zr. Isolde Dietrich (Siemens and Halske A. G., Munich), Reinhard Weyl, and Ulrich Zwicker. Z. Metallk., 53: 721-8 (Nov. 1962). (In German)

Investigations on the superconductivity of thin wires made from alloys of the binary systems niobium–titanium and niobium–zirconium showed that cold working changed the critical temperature only to a small extent and that the microscopic structure greatly influenced the high critical values. High values were found if a shell-like lamellar structure was present. Time and temperature of annealing have to be chosen in a way that no agglomeration into a granular structure can occur. By application of such annealing processes a high critical current density was achieved. (auth)

8859 DATA ON SOUND VELOCITIES IN PURE METALS. Karl Heinz Schramm (Battelle-Institut e. V., Frankfurt am Main). Z. Metallk., 53: 729-35(Nov. 1962). (In German)

The velocities of sound and Poisson's ratio of some pure metals were calculated using the modulus of compression K and Young's modulus of elasticity E. The theoretically determined data of the temperature dependence of K in combination with measured data of E gave changes of the sound velocities and Poisson's ratio over a wide temperature range. In addition references are presented concerning measured data for molten state as well as at room temperature. Data are given for some 59 pure metals including 40 metals for which temperature dependence of the parameters was calculated. (auth)

8860 ON THE STRUCTURE OF THE SYSTEM Ru–Ce. Walter Obrowski (DEGUSSA, Hanau, Ger.). Z. Metallk., 53: 736-7(Nov. 1962). (In German)

The constitution of the system Ru–Ce was examined by means of microscopic and radiographic methods as well as thermal analysis. Besides Ru and Ce solid solutions the Laves phase Ru_2Ce was formed peritectically at 1570°C. Together with Ce solid solutions it formed a eutectic composition solidifying at 645°C. The hexagonal Ce mixed crystal that crystallizes from melt showed a eutectoid decomposition. (auth)

8861 ROENTGENOGRAPHIC INVESTIGATION OF THE SEPARATION PROCESSES IN MAGNESIUM–LEAD AND MAGNESIUM–ZINC ALLOYS. II. THE SEPARATION OF THE STABLE EQUILIBRIUM PHASE. Siegfried Henes and Volkmar Gerold (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 743-8(Dec. 1962). (In German)

In the magnesium–lead system at aging temperatures from 130 to 200°C, the precipitation of the stable phase Mg_2Pb (A) occurs in two different orientations relative to the matrix (M): $(110)_A \parallel (0001)_M$, $[001]_A \parallel [2\bar{1}\bar{1}0]_M$; and $(110)_A \parallel (0001)_M$, $[1\bar{1}1]_A \parallel [2\bar{1}\bar{1}0]_M$. At higher aging temperatures other orientation relationships also exist; two of them were determined to be $(111)_A \parallel (0001)_M$, $[2\bar{1}\bar{1}]_A \parallel [2\bar{1}\bar{1}0]_M$ and $(111)_A \parallel (0001)_M$, $[1\bar{1}0]_A \parallel [2\bar{1}\bar{1}0]_M$. The proportion of the precipitation in the first two orientation relationships was investigated as a function of aging temperature, impurities, etc. An aging stage found by K. Hirano et al. with calorimetric methods could not be detected in the alloy either by calorimetric or by x-ray methods. In the magnesium–tin system at aging temperatures from 160 to 300°C the same orientation relationships were found between precipitation and matrix as in Mg–Pb alloys. The proportion of the precipitation with the first two orientation relationships showed a different temperature dependence. Microscopic investigations showed the precipitates forming plates parallel to (0001), $(10\bar{1}2)$, and $(10\bar{1}1)$ planes of the matrix. No relationships were found between the orientation of the plates and the orientation of the atomic structures in the precipitates. (auth)

8862 CONCERNING TERNARY BORIDES WITH CHROMIUM CARBIDE ($Cr_{23}C_6$) STRUCTURE. Hans H. Stadelmaier and Tong S. Yun (North Carolina State Coll., Raleigh). Z. Metallk., 53: 754-6(Dec. 1962). (In German)

Ternary borides with a $D8_4$ structure were formed in the ternary systems cobalt–aluminum–boron, cobalt–gallium–boron, cobalt–tin–boron, nickel–magnesium–boron, nickel–aluminum–boron, nickel–zinc–boron, nickel–gallium–boron, nickel–germanium–boron, nickel–indium–boron, and nickel–tin–boron. The B-metal atoms occupy preferentially the point position "c" of the lattice, then "a". The B-metal content decreases with increasing valence of the B-metal, in qualitative agreement with the rules of W. Hume-Rothery. The carbo-boride previously known as $Fe_{23}(B,C)_6$ has the composition $Fe_{23}B_3C_3$. (auth)

8863 DEFORMATION AND RECRYSTALLIZATION TEXTURES OF NICKEL AND OF ALLOYS ON NICKEL

BASE. C. A. Clark and P. B. Mee (International Nickel Co. Ltd., Birmingham, Eng.). Z. Metallk., 53: 756-64 (Dec. 1962). (In German)

The roll deformation texture for high purity nickel strip can be described approximately as a spread around the four equivalent ideal orientations of the type (123) [1$\bar{2}$1]. The annealing texture is essentially the cube texture (100) [001]. In nickel and nickel containing small amounts of chromium and cobalt, small reductions, about 40%, produce a small degree of texture around the (123) [1$\bar{2}$1] orientation. The slight amount of cube texture produced on annealing does not significantly reduce the Young's moduli of the alloys. For a given amount of reduction, a more pronounced roll texture, around the (123) [1$\bar{2}$1] orientation, is produced in dispersion hardened nickel than in high purity nickel. The annealing texture of dispersion hardened nickel is cube, with pronounced twin components. Most of the grains appear to be twinned, even after annealing for 1 hour at 1200°C. The roll texture for Nimonic 75, 80A, and 90 strip, reduced by 40%, can be described approximately as a spread around the ideal (110) [$\bar{1}$12] and (112) [11$\bar{1}$] orientations. Nimonic 80 A and 90 recrystallize to random grain orientation. For Nimonic 75 the recrystallization texture is similar to the roll texture, but appears to be sharper and to have a stronger (112) [11$\bar{1}$] component. The high temperature extrusion texture of nickel is random, but that of dispersion hardened nickel is predominantly cubic. The high temperature extrusion texture of the Nimonic alloys tends to be cubic, but the proportion of randomly oriented grains increases with the total titanium + aluminum content. The drawing texture of nickel wire consists mainly of (111) fibre texture; the annealing texture of drawn nickel wire, drawn 83%, is random for annealing temperatures below 600°C. The drawing texture of dispersion hardened nickel wire may be a mixture of (111) and (100) fibre textures; during annealing the proportion of (100) fibre texture increases slightly. (auth)

8864 CONCERNING THE SYSTEM ZIRCONIUM–HYDROGEN. Juergen Motz (Internationale Atomreaktorbau GmbH, Cologne). Z. Metallk., 53: 770-4(Dec. 1962). (In German)

A literature survey covering the past 10 years and some experimental work were carried out on the hydrogen–zirconium system in order to obtain further information on the phase relationship. Thermoanalytic and dilatometric studies, measurements of the hydrogen pressure, and x-ray investigations, all performed with alloys containing more than 40 at.% hydrogen, gave some information about the constitution of the zirconium–hydrogen system. (auth)

8865 GERMANIUM–RUTHENIUM ALLOYS. Ernst Raub and Walter Fritzsche (Research Inst. for Noble Metals and Metal Chemistry, Schwäbisch Gmünd, Ger.). Z. Metallk., 53: 779-81(Dec. 1962). (In German)

Germanium–ruthenium alloys were examined by means of microscopy, radiography, and partly thermal analysis. In the system a B20 phase at the composition GeRu and a tetragonal phase of the composition Ge_2Ru_3 being isotopic with Si_2Ru_3 were found. Ruthenium and germanium do not form solid solutions. Also neither of the intermediate phases had a demonstrable range of homogeneity. (auth)

8866 PHYSICAL AND PROCESS METALLURGY AND PHYSICOCHEMICAL RESEARCH METHODS. Translation by A. Aladjem, I. Geller, and C. Nissenbaum of Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR, No. 3, (1958). 341p. (OTS-60-51087; PST Cat. No. 386). $3.50(OTS).

Thirty-one papers are presented on a variety of topics in metallurgy and properties of metals and alloys. Separate abstracts were prepared for three papers dealing with heat-resistant alloys, mechanical properties of zirconium, and the electrical resistance and melting point of metals. (D.L.C.)

8867 THE THEORY OF FORMATION OF HEAT-RESISTANT ALLOYS. L. I. Gomozov. p.142-58 of "Physical and Process Metallurgy and Physicochemical Research Methods." OTS-60-51087; PST Cat. No. 386.

A qualitative discussion of deformation and diffusion in solid substances is presented. It is shown that deformation or diffusion is associated with overlapping electron shells in the ions and with an increase of electron density in local regions and a consequent increase in the repulsive forces. The energy of interionic repulsions should affect the heat resistance of a substance and the diffusibility of atoms and depends on structural factors, e.g., ionic rigidity and temperature. The elements in a heat-resistant alloy can be differentiated according to their ionic rigidity and hardening effects. The concept of rigid ions facilitates the explanation of laws of diffusion, melting, deformation at high temperatures, brittle fracture, etc., from a unified point of view. (D.L.C.)

8868 MECHANICAL PROPERTIES AND RECRYSTALLIZATION DIAGRAM OF ZIRCONIUM IODIDE. E. M. Savitskii and V. F. Terekhova. p.192-201 of "Physical and Process Metallurgy and Physicochemical Research Methods." OTS-60-51087; PST Cat. No. 386.

As a result of investigation of the influence of temperature (from −195 to 1,200°) on the mechanical properties of iodide zirconium, it was found that the hexagonal α-zirconium modification which is stable up to 862° has a considerable plasticity, even at the boiling point of liquid nitrogen (−196°). The cubic body-centered β-zirconium which is stable above 862°, has higher plasticity than α-zirconium. The polymorphic transformation $\alpha \rightleftharpoons \beta$ in zirconium is characterized by the existence of a bend in the curve of the temperature versus mechanical properties, especially when representing them in semilogarithmic coordinates. The relationship between the grain size, degree of deformation on cold rolling, and annealing temperature was investigated, and a recrystallization diagram was plotted. From the point of view of obtaining uniform fine grains the temperature range of 700 to 750° is the optimum interval for annealing of cold-worked iodide zirconium. (auth)

8869 DEVICE FOR DETERMINING THE ELECTRICAL RESISTANCE AND THE MELTING POINT OF METALS AND ALLOYS. N. A. Kiselev. p.280-7 of "Physical and Process Metallurgy and Physicochemical Research Methods." OTS-60-51087; PST Cat. No. 386.

The vacuum device designed for measuring electrical resistance permits the determination of melting points in the 500 to 3,410° range. For melting pure metals, the discrepancies between repeated temperature measurements are ±5° at temperatures below 1,500° and ±10° above this temperature. The device makes it possible to determine the point at which melting begins. This is achieved by noting the sharp increase of electrical resistance at the initial moment of melting. This method is especially valuable for the examination of alloys. The temperature dependence of electrical resistance of Zr, Ti, and of a Ti-alloy with 5% Al was studied with the vacuum device. The obtained results and their comparison with data published in other sources make it possible to study phase transformations with this device; a thermal analysis may be carried out simultaneously. (auth)

8870 BASIC MATERIALS FOR THE ATOMIC ENERGY INDUSTRY. New York, National Lead Company, [1962]. 40p.

Data are presented for the chemical, mechanical, physical, and other properties of the following materials: uranium, thorium, lead, zirconium, titanium, bismuth, cadmium, nickel, cobalt, barite, and magnetite. The nonnuclear uses of depleted uranium and special fabrications are considered briefly. (D.L.C.)

8871 TEPLOVYDELYAYUSHCHIE ELEMENTY ATOMNYKH REAKTOROV. (Fuel Elements in Nuclear Reactors). A. S. Zaimovskii, V. V. Kalashnikov, and I. S. Golovnin. Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962. 370p.

A survey is made of various nuclear fuels and their reactions with structural materials and of structural materials reactions with coolants. An analysis is made of the combined effects of thermal, mechanical, and radiation reactions on the fuel and construction materials. The book was designed for scientists, engineers, and technicians working with nuclear energy and technology. (R.V.J.)

8872 UNCOOLED ROCKET NOZZLES FOR ULTRA-HIGH TEMPERATURE PROPELLANTS. George Kraus. Preprint 595J. New York, Society of Automotive Engineers, Inc., 1962. 4p. $1.00.

Paper from National Aerospace Engineering and Manufacturing Meeting, Los Angeles, Oct. 8-12, 1962.

The pyrolytic graphite nozzle extends the capability of uncooled lightweight nozzles to future ultrahigh temperature propellants by utilizing a novel application of pyrolytic graphite. The pyrolytic graphite is used as a heat sink rather than an insulator by having it oriented to conduct heat away from the hot surface to the interior of the nozzle. The results of small scale tests using propellants with flame temperatures up to 6550°F are presented. Some mention of full scale nozzle design is also made. (auth)

8873 HIGH-TEMPERATURE METALLIC FABRIC FOR RE-ENTRY APPLICATIONS. J. T. Harris. Preprint 590A. New York, Society of Automotive Engineers, Inc., 1962. 4p. $1.00.

Paper from National Aerospace Engineering and Manufacturing Meeting, Los Angeles, Oct. 8-12, 1962.

Materials used in expandable structures for aerospace missions must be flexible, have high temperature resistance, and show high strength-weight ratios. The development and technology of such materials and their use with the various categories of space vehicles are discussed. (auth)

8874 TENSILE AND SHEAR PROPERTIES OF SEVERAL SOLDERS AT CRYOGENIC TEMPERATURES. J. L. Christian and J. F. Watson. Preprint 595E. New York, Society of Automotive Engineers, Inc., 1962. 8p. $1.00.

Paper from National Aerospace Engineering and Manufacturing Meeting, Los Angeles, Oct. 8-12, 1962.

The tensile and shear properties of eight soft solders were determined at several loading rates at 78, -100, -320, and -423°F. In general it was found that the tensile and shear strengths increased with increase in loading rate and decrease in temperature. Large decreases in ductility, as measured by elongation and reduction in area, and decreased tensile and shear strengths for some of the solders at cryogenic temperatures are indicative of their low temperature embrittlement. A discussion of the experimental data and literature values is given and recommendations are made concerning the application of solders for cryogenic service. (auth)

8875 URANIUM BASE ALLOY. (to U. S. Atomic Energy Commission). British Patent 912,960. Dec. 12, 1962. Priority date Apr. 14, 1959, United States.

Uranium base alloys having improved mechanical properties for reactor use comprise 0.1 to 1 wt % Al, 2 to 6 wt % Mo, and balance U. The preferred composition is 0.5 wt % Al and 3.5 wt % Mo. The yield, tensile strengths, and creep resistance of the alloys are greater than these of U metal by factors of 3 to 5. Results are reported for tensile, creep, and thermal cycling tests at high temperatures. (D.L.C.)

8876 DUCTILE CHROMIUM. Stanley J. Paprocki and George W. Cunningham (to U. S. Atomic Energy Commission). U. S. Patent 3,074,153. Jan. 22, 1963.

A method is described for producing ductile Cr. From 1 to 40 wt % U nitride as an additive has been found to produce ductility in metallic Cr. (AEC)

Radiation Effects

8877 (AFCRL-62-316) RESEARCH DIRECTED TOWARD THE STUDY OF THE RADIATION DAMAGE THRESHOLDS OF THE ELEMENTS. Final Report. R. M. Walker (General Electric Co. Research Lab., Schenectady, N. Y.). June 1962. Contract AF19(604)-5557. 9p. (AD-277008)

Most of the work carried out consisted of measurements and analysis of electron induced radiation damage in the following metals: Al, Ag, Au, Cu, Fe, Mo, Ni, Ti, W, and Zn. The results of this work are reviewed. Recent work on the electron microscope observation of radiation damage is also discussed. (auth)

8878 (BNL-6051) RADIATION AND ATOMIC REARRANGEMENT IN ALLOYS. A. C. Damask (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 28p.

The most important basic processes arising from the interaction of high-energy radiation with solids may be classified as production of displaced electrons, production of displaced atoms by elastic collision, and thermal and displacement spikes. The basic processes of radiation damage are discussed and illustrative examples are given. Damage in metals and alloys are considered in detail. (W.D.M.)

8879 (BNL-6053) ANNEALING OF RADIATION INDUCED DEFECTS IN FUSED SILICA. Paul W. Levy (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract [AT(30-2)-Gen-16]. 3p.

The effects of purely ionizing radiation on glasses and crystals lie in the redistribution of electrons and holes and the formation of color centers in impurities or defects. On the other hand, energetic particles such as fast neutrons form atom recoils and thus produce defects. The coloring of defects by, say, gamma rays could be used to study the thermal annealing of reactor-induced defects. This method was used to study the absorption bands induced by reactor radiations at ~70°C in pure fused silica. The annealing was conducted in stages from 70 to 550°C, and the defects were recolored to saturation by gamma rays after each stage. The saturation coloring vs annealing temperature curve was nearly linear, and the results indicate that some defects remain up to 675°C. (D.L.C.)

8880 (BNL-6055) THE TEMPERATURE DEPENDENCE OF BIREFRINGENCE IN IRRADIATED POLYETHYLENE. B. Keneally, J. Gard, and G. Adler (Brookhaven National Lab., Upton, N. Y.). [Mar. 7, 1962]. Contract [At(30-2)-Gen-16]. 12p.

The birefringence of irradiated polyethylene was observed as a function of temperature. The data are consistent with a mechanism in which crosslinking limits the

growth and annealing of crystallites. Crosslinks formed in oriented material results in an oriented gel. This effect explains the birefringence and the persistence of nucleation sites at high temperatures. (D.L.C.)

8881 (CRFD-1118) THE CALCULATION OF HEAT RATINGS OF UO_2 FUEL SPECIMENS IRRADIATED IN THE HYDRAULIC RABBIT LOOP OF NRX FROM COBALT MONITOR ACTIVATIONS. M. J. F. Notley, G. M. Allison, and A. S. Bain (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nov. 1962. 16p. (AECL-1551)

The calculation of heat ratings of specimens irradiated in the Hydraulic Rabbit depends on experimentally determined parameters. A series of irradiations was performed to define some of these values more exactly. A previous assumption that the ratio of the neutron flux at the fuel surface to the flux at the cobalt monitor position was substantially independent of enrichment was found to be in error. The irradiations are described. The calculations used in estimating the power developed in fuel specimens are given. Although the numerical values obtained are specific to the standard Hydraulic Rabbit specimens, the principles involved apply to all fuel irradiations. (auth)

8882 (EURAEC-306) SOLID STATE NEUTRON DETECTOR. Quarterly Report No. 6, January 1–March 31, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 079-61-10RDB III.3.1. 20p.

P–N junctions with relatively good characteristics were obtained by diffusion of Al into n-type SiC single crystals. The width of the barrier was estimated to be of the order of 1 μ, lying some 50 μ underneath the surface. A summary is given about the change of the electrical characteristics and the short-circuit photocurrent of grown SiC p–n junctions upon reactor irradiation. Resistivity and Hall coefficient measurements as a function of temperature were made on one n-type and three p-type single crystals of SiC after irradiation in the BRI reactor. These measurements indicated that p-type SiC is converted to n-type SiC after a fast neutron bombardment of $nvt_f = 2.2 \times 10^{17}$ cm^{-2}. The n-type material remained of the same type after an exposure of $nvt_f = 3.8 \times 10^{18}$ cm^{-2}. For the two types the resistivity was markedly increased upon irradiation. The slope of the log ρ vs. 1/T curve corresponded to an energy of 0.47 ev (or twice this value) for the n-type material and 0.24 ev (or 0.48) for the converted p-type material. The Hall mobility for electrons in the n-type specimen decreased by a factor of two at 550°K. (auth)

8883 (GA-2802) HIGH-ENERGY NEUTRON-INDUCED CHANGES IN CARBON AND GRAPHITE. A Review. Glen B. Engle (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Sept. 20, 1962. Contract AT(04-3)-314. 110p.

The pertinent data on the effects of high-energy neutron bombardment on carbon and graphite structure, dimensional stability, properties, and some gas reactions are presented. The basic raw materials and general processes of fabricating nuclear graphite are reviewed and a series of models are presented for the structure of carbon and graphite. The irradiation data are reviewed with emphasis on correlation of irradiation effects with basic carbon structure. (auth)

8884 (HW-75428) RADIATION DAMAGE IN GRAPHITE BY HIGH ENERGY ELECTRONS. I. T. Myers (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 29, 1962. Contract AT(45-1)-1350. 10p.

A 2-Mev Van de Graaff electron accelerator was used to obtain measurements of radiation damage to NPR and KC graphite. These measurements included length changes, lattice spacing changes, and resistivity changes upon electron irradiation. It was found that significant quantities of ozone were produced when liquid nitrogen was used as a coolant. (auth)

8885 (MITNE-22) THE IRRADIATION OF SANTOWAX OMP IN THE M.I.T. IN-PILE LOOP. PART II. EQUIPMENT DESIGN, PROCEDURES AND RESULTS OF IRRADIATION TO OCTOBER 5, 1961. D. T. Morgan and E. A. Mason (Massachusetts Inst. of Tech., Cambridge). May 1962. Contract AT(10-1)-1067. 643p. (IDO-11105)

Issued in two books.

An operational in-pile loop in the M.I.T. nuclear reactor is now available for testing organic materials suitable for use as moderator-coolants in nuclear reactors. A detailed description of the loop is presented. The first in-pile irradiation using Santowax OMP as the test material was started and data on the physical and chemical properties of the irradiated Santowax OMP obtained during the irradiation period up to October 5, 1961, are presented. During this period, the concentration of radiolytic degradation products in the coolant increased from ~0 to 39 wt %. Forced convection heat transfer measurements were made throughout the irradiation period and correlations of the data are presented. The use of Wilson's method for the study of fouling is also discussed and illustrated, using the heat transfer data. Extensive calorimetric measurements of the dose rate in the position occupied by the in-pile section of the loop were made, using a special adiabatic calorimeter developed for this purpose. Based on these results, the fast neutron and the gamma dose rates in any organic material of known composition can be estimated. Measurements of the thermal, epithermal, and fast neutron fluxes were also made, before and after installation of the in-pile section of the loop in the reactor, using neutron-absorbing foils. Based on these dose rate measurements and the measured concentrations of each terphenyl isomer in the coolant (ortho-, meta-, and para-) in this experiment, the decomposition yields were found to be: $G^*(-i) = G(-i)/C = 0.28 \pm 0.03$(molecules of component i degraded/100 ev absorbed)/(wt fraction of component i) for each of the terphenyl isomers. $G^*(-i)$ is not significantly affected by the concentration of degradation products. This, as well as the other results of this investigation, to date, have generally been similar to those reported previously for Santowax R at the same temperature and thus generally support the reactor the reactor design studies that were reported. (auth)

8886 (NAA-SR-6514) IRRADIATION TEST OF GADOLINIUM AND SAMARIUM OXIDES FOR THE HNPF CONTROL ROD PROGRAM. T. E. Redding (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Nov. 30, 1962. Contract AT(11-1)-Gen-8. 25p.

A long-term irradiation test of the rare earth oxide materials proposed for use as neutron absorber materials in the HNPF was conducted to establish the radiation stability of these materials with regard to their dimensional, chemical, and thermal characteristics. The materials were exposed to approximately $5 \times 10^{20} \pm 10\%$ nvt at the surface of the cylindrical containers. Results of the test indicate that no appreciable changes in oxide container dimensions occurred. It was also found that the apparent thermal conductivity of the mixed oxides (45% Gd_2O_3–45% Sm_2O_3) (balance low cross section materials), irradiated at 950 and 1200°F, remained constant, at 1.25 ± 0.05 and 1.05 ± 0.05

Btu/hr-ft-°F, respectively; and the apparent thermal conductivity of the 90% Gd_2O_3 (balance low cross section materials), irradiated at 1200°F, remained essentially constant, at 1.30 ± 0.10 Btu/hr-ft-°F. Power generation in the poison materials remained constant, at about 1.30 ± 0.1 kw/ft-10^{13} nv in the mixed oxides, and about 1.40 ± 0.1 kw/ft-10^{13} nv in the 90% Gd_2O_3. He gas, with which the oxide containers had been pressurized, was either lost through leaks in the containers or absorbed by the oxides. No appreciable change in oxide particle sizes occurred and the generation of heat in the poison material was apparently uniform, since calculated temperature profiles, based on the assumption of uniform heat generation, agreed closely with measured temperature profiles. (auth)

8887 (NASA-TN-D-1490) IRRADIATION EFFECTS OF 40 AND 440 Mev PROTONS ON TRANSISTORS. William C. Honaker and Floyd R. Bryant (National Aeronautics and Space Administration. Langley Research Center, Langley Station, Hampton, Va.). Jan. 1963. 41p.

Experimental results present data collected before, during, and after the bombardment of several types of transistors with 40 and 440 Mev protons. The degradation of the measured parameters varied with proton energy and with the alpha cutoff frequency of the transistor. Figures are presented which show the degradation of the gain of the transistors as a function of integrated proton flux. (auth)

8888 (PAN-357/XVII) VLIYANIE GAMMA IZLUCHENIYA NA RABOTU VYKHODA ELECTRONA IZ POVERKHNOSTEI METALLOV: Pt, Au, I Co. (The Influence of Gamma-Radiation on the Electron Work Function from the Surfaces of Metals: Pt, Au and Co). Stefan Mints and Yuliush Seika (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Sept. 1962. 16p.

The influence of gamma radiation on the changes of electron work function has been investigated for Pt, Au, and Co covered with their own oxide layers. The application of a dynamic condenser made possible both the irradiation and measurement of the work function in vacuum of the order of 10^{-5} mm Hg. The influence of total dose of gamma radiation on the work function has been measured for surfaces of different degree of oxidation. (R.J.S.)

8889 (TID-17776) A REVIEW OF SOME GAMMA RADIATION EFFECTS ON GLASS. Adli M. Bishay (Argonne National Lab., Ill.). Oct. 1962. Contract [W-31-109-eng-38]. 27p. (UAC-7008)

Characteristic optical absorption bands are induced in glass subjected to ionizing radiation. Different factors affecting the induced absorption are discussed. The effect of addition of multivalent ions to the glass is stressed. Cerium, when added to different types of glasses, is known to suppress the induced visible coloration normally observed for glasses subjected to ionizing radiation. This role of cerium, as well as the necessity of its presence as a mixture of Ce^{3+} and Ce^{4+}, is discussed. (auth)

8890 (EURAEC-494) INVESTIGATION INTO THE INFLUENCE OF AN EXPOSURE TO NEUTRONS UPON THE PROPERTIES OF THE Zr–3%Nb–1%Sn ALLOY. Quarterly Report No. 1, July 1 to September 30, 1962. (Metallgesellschaft A. G., Frankfurt am Main). Work Performed under United States–Euratom Joint Research and Development Program. Contract 092-62-7RDD. 13p. A translation.

A series of tests in a swimming pool reactor are planned to investigate neutron exposure effects on the mechanical properties and the resistance to corrosion of the Zr alloy Zr–3%Nb–1%Sn. Work was started with the preparation of the test material. A series of billets of Zircaloy-2 and of the alloy Zr–3%Nb–1%Sn were smelted under vacuum in the electric arc furnace. The billets were machined into rods and foils from which the samples needed for the tests were prepared. (R.J.S.)

8891 SOME NEW RESULTS FROM LOW-ENERGY PROTON IRRADIATION OF SILICON SOLAR CELLS. E. A. Lodi and D. L. Crowther (Lockheed Missiles and Space Co., Palo Alto, Calif.). Appl. Phys. Letters, 2: 3-4(Jan. 1, 1963).

Silicon solar cells are irradiated with 100 and 500 kev protons to give further information on the effects of space radiation on such cells. Current and voltage variations are graphed and discussed. (D.C.W.)

8892 EFFECT OF AN ELECTRIC FIELD ON THE DIELECTRIC PERMITTIVITY OF NEUTRON IRRADIATED BARIUM TITANATE CERAMICS. B. Hilczer (Inst. of Physics, Polish Academy of Sciences). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 10: 353-6(1962). (In English)

The dielectric permittivity of $BaTiO_3$ samples in electric fields of 0.5 to 15 kv/cm is measured as a function of neutron doses up to 10^{19} n/cm^2. The permittivity is measured at a frequency of 1 Mc. The effect of annealing the samples for 15 min at 200°C is also studied. The results indicate that the samples lose their ferroelectric nature upon neutron irradiation. (T.F.H.)

8893 RADIATION DAMAGE IN QUARTZ. E. V. Kolontsova and I. V. Telegina (Moscow Univ.). Dokl. Akad. Nauk SSSR, 147: 592-3(Nov. 21, 1962). (In Russian)

Changes in the crystal structure of quartz at a neutron dose of 10^{19} n/cm^2 are marked by an increase in the reflected, x-ray maxima. On increasing the dose to 7×10^{19} n/cm^2, the diffraction picture changes radically. The third-order symmetry of α-quartz changes to a six-order symmetry. From $\theta = 6^0$ to $\theta = 17^0$, halos appear that are characteristic of x-ray scattering by amorphous substances. The Laue maxima are noticeably less intense. The interference maxima are considerably weakened. These physical changes are associated with the creation of random point defects in the crystal structure. It is possible that radiation converts α-quartz to β-quartz, or to a twinned form. (TTT)

8894 THE EFFECT OF γ-RADIATION ON Na_2O–Al_2O_3–SiO_2 GLASSES. V. V. Vargin and S. A. Stepanov. Dokl. Akad. Nauk SSSR, 147: 609-11(Nov. 21, 1962). (In Russian)

Glasses containing 13 to 40 mol % Na_2O and from 0 to 35 mol % Al_2O_3 were subjected to a total dose of 5×10^8 r (in some cases, 3×10^7 r), and the absorption spectra before and after irradiation were measured on a spectrophotometer at wavelengths of 210 to 1100 mμ. The difference in optical density before and after irradiation (ΔD) is plotted against the wavelength (λ), expressed in electrovolts. Five absorption bands at 2, 2.8, 4, 5, and 5.6 ev were detected in glasses containing 15 and 25 mol % Na_2O. An increase in the Al_2O_3 content leads to a decrease in intensity of all absorption bands, except the 4 ev band which remains constant. The 5 and 5.6 ev bands are due to a deficiency in oxygen available for forming bridges. These bands vanish with increasing concentration of Na_2O and Al_2O_3. The 2.0 and 2.8 ev bands are due to oxygen which does not enter the structure in the form of bridges. With the content of $Al_2O_3 > Na_2O$, the 2.0 and 2.8 ev bands disappear, and a new band appears at 3.4 ev. This behavior is due to the formation of AlO_4^- tetrahedrons. A quartz-like glass, consisting of SiO_4 and AlO_4^- tetrahedrons, is formed under these conditions. The Na^+ ions are distributed around the AlO_4^- tetrahedrons

for charge compensation. The 3.4 ev absorption band is due to excess Al^{3+} having a coordination number of six. On heating a glass containing 15 mol % Al_2O_3 for 10, 20, 50, and 80 min at 100°C after irradiation with a dose of 3×10^7 r, the thermal stability of the 2.0 and 2.8 ev bands increases, while the 4, 5, and 5.6 ev bands are the least stable. (TTT)

8895 ON THE CREEP OF IRRADIATED RODS. M. I. Rozovskii (Dnepropetrovsk Mining Inst., USSR). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.-Mat. Nauk, 15: 55-63(1962). (In Russian)

An attempt was made to develop a precise solution for a linear integral-operator equation for the relative intensity $\sigma(x, t)$, $\sigma = F + (M - N)\sigma$, such that the deformation along an iron rod may be determined at any arbitrary time, including $t \to \infty$. (R.V.J.)

8896 GAMMA EFFECTS ON DIELECTRIC PROPERTIES OF INSULATION MATERIALS. I. METHODS FOR MEASURING DIELECTRIC PROPERTIES DURING IRRADIATION. B. I. Vorozhtsov, V. M. Nesterov, E. A. Zamotrinskaya, and I. S. Filatov (Siberiun Inst. of Physics and Tech., Tomsk State Univ., USSR). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 4, 163-70(1962). (In Russian)

Measurements were made of the electric conductivity, penetrability, dielectric losses, and electric resistance of insulation materials exposed to 1.25-Mev γ radiation at 20 r/sec. The electric conductivity was measured with accuracies from 4% at $\sigma = 10^{-12}$ to 10^{-14} to 40% at $\sigma = 10^{-19}$ ohm^{-1} cm^{-1}. The dielectric losses were studied at frequencies of 40 to 10^5, 10^6, 10^7, 3×10^9, and 10^{10} c/sec. The order of error for tg δ at 40 to 10^5 c/sec and 3×10^9 to 10^{10} c/sec was about 10%, for 10^6 to 10^7 and 10^9 to 10^{10} c/sec and tg $\delta = 10^{-4}$ the order of error was 30%. The order of error for penetrability was 3%. The measured characteristics of polyethylene and plastic AG-4 are tabulated. (R.V.J.)

8897 X-RAY IRRADIATION EFFECTS ON POTASSIUM IODIDE. C. H. Ma and J. Makris (International Business Machines Corp., Poughkeepsie, N. Y.). J. Appl. Phys., 34: 441-2(Feb. 1963).

Electron-microscopic evidence of changes in the surface of a single crystal of potassium iodide is considered. The crystal and a control crystal were grown by slowly cooling molten potassium iodide. After polishing, they were etched in methyl alcohol. Surfaces are shown after 16 hr of "white" copper irradiation. (W.D.M.)

8898 VARIATION-PERTURBATION APPROACH TO THE INTERACTION OF RADIATION WITH MATTER. M. Karplus (Columbia Univ., New York). J. Chem. Phys., 37: 2723-4(Dec. 1, 1962).

A variation-perturbation technique is outlined as an alternative to the ordinary time-dependent perturbation method. The essential point of the technique is to factor out the effective time dependence of the perturbed wavefunction and to reduce the remaining problem to the solution of time-dependent inhomogeneous differential equations. For simple cases a direct integration is possible, while a variational approach is applicable to more complex equations. (P.C.H.)

8899 THERMAL DECOMPOSITION ALONG DISLOCATIONS. J. Jach (Picatinny Arsenal, Dover, N. J.). Nature, 196: 827-9(Dec. 1, 1962). (BNL-6303)

The effects of relatively low temperature and prolonged irradiation or cold-working on the kinetics of thermal decomposition along dislocations were investigated. Data are presented on the effects of β irradiation and temperature on the decomposition of polycrystalline $NaBrO_3$ and colloidal α-PbN_6, and the effect of prolonged neutron irradiation and temperature on the decomposition of dehydrated nickel oxalate. It is concluded that irradiation may induce decomposition preferentially along damage tracks and such a mechanism may result in linear kinetics. Irradiation may also introduce mechanical defects resulting from large strains imposed on the crystal by decomposition products. (C.H.)

8900 PARAMAGNETIC RESONANCE SPECTRA OF ALKALI BORATE GLASSES IRRADIATED WITH GAMMA RAYS. Yasuo Nakai (Tokyo Shibaura Electric Co. Ltd. Kanagawa). Nippon Kagaku Zasshi, 82: 1629-33(1961).

Borate glasses containing alkali oxides were irradiated with γ rays at room temperature. The samples were pulverized and enclosed in a glass tube in vacuo. The total dose was $\sim 5 \times 10^6$ r. The electron-spin resonance absorption of the irradiated glass was measured at 9000 Mc. The glass samples showed a prominent resonance absorption of $g = 2.0$, with minor differences in their structures. Fused borate and alkali borate glasses displayed a magnetic hyperfine structure of 4 peaks separated from each other by 13.5 gauss. The magnetic hyperfine structure may be ascribed to B^{11} with $I = 3/2$. A defect model by which an electron is removed from an oxygen atom seems adequate to account for the observed magnetic hyperfine structure. The alkali borate glasses showed additional resonance absorption, which seems to originate from alkali metals. The presence of H_2O or OH^- ion in glass and water absorbed on the glass surface inhibited the formation of radioinduced defect centers. (H.H.D.)

8901 PHONON-BATH BOTTLENECK IN NEUTRON IRRADIATED MgO. I. M. Firth and D. Bijl (Univ. of St. Andrews, Scotland). Phys. Letters, 2: 160-1(Sept. 1, 1962). (In English)

The electron spin-lattice relaxation of six samples of neutron irradiated MgO, of varying spin density, has been measured in the temperature range 1.4 to 4.2°K at 9.4 kMc/sec. The microwave spectrum of the samples consisted of a strong F-center line and an equally spaced sextet due to impurities in the MgO. The single phonon process is shown to be dominant, but in weak samples the recovery from the inverted state is not described by a single exponential and seems to be determined by cross-relaxation with nearby impurity lines. In strong samples the relaxation takes place with two exponentials that show a discontinuity at saturation. This behavior is attributed to a phonon-bath bottleneck in samples of large dimensions. (H.D.R.)

8902 ABSORPTION OF M AND R CENTERS IN THE F BAND REGION OF COLOURED ALKALI HALIDES. K. G. Bansigir and E. E. Schneider (King's Coll., Newcastle-upon-Tyne, Eng.). Phys. Letters, 2: 250 (Oct. 1, 1962). (In English)

The model for secondary color centers in alkali halides as aggregates of F centers predicts that transition moments normal to the axis of M centers and normal to the plane of R centers should exist, leading to absorptions close to the F band. Such absorptions have been identified as partially resolved peaks in the F band region in x-ray colored single crystals bleached with polarized light under shearing stress in the 110 directions. The various M_F and R_F absorption peaks for NaCl, KCl, and KBr are presented and discussed. (H.D.R.)

8903 EFFECT OF PLASTIC DEFORMATION ON NEUTRON IRRADIATION DAMAGE IN COPPER AND ALUMINUM AT 1.8°K. M. L. Swanson, G. R. Piercy, and D. J.

Mackinnon (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. Letters, 9: 418-21(Nov. 15, 1962).

Neutron irradiation of annealed and cold-worked Cu and Al was undertaken to check the validity of the focusing collision model used to interpret many irradiation effects. The irradiation damage was determined by measuring electrical resistivities. The damage rate of deformed Cu was approximately 10% greater than that of annealed Cu, in agreement with previous measurements. An unexpected enhancement of 32.2% was found for a deformed Al sample. This result was supported by experiments on several different samples and indicates that long-range transfer of energy is important in irradiated Al. (H.D.R.)

8904 EFFECT OF Co^{60} γ RAYS ON VITAMIN B_1 HYDROCHLORIDE CRYSTALS. Tomoo Takahashi (Shionogi & Co., Ltd., Osaka). Yakugaku Zasshi, 82: 1157-60 (Aug. 1962). (In Japanese)

When α-type crystals of thiamine hydrochloride were irradiated with 4×10^7 to 1×10^8 r, they were found to be more stable than control, nonirradiated thiamine hydrochloride crystals when compounded in a powder with calcium carbonate. The irradiated thiamine hydrochloride was found to have higher density and lower hygroscopicity than the nonirradiated salt, and a marked difference was found between them in relative intensities in x-ray diffraction patterns of the powdered crystals. (H.H.D.)

8905 INVESTIGATIONS ON LATTICE DEFECTS IN NEUTRON-IRRADIATED LITHIUM FLUORIDE. Hans Peisl (Technische Hochschule, Munich). Z. Angew. Phys., 14: 529-36(Sept. 1962). (In German)

Lithium fluoride single crystals were irradiated in the Munich-Garching Research Reactor with neutron doses from 10^{15} to 4×10^{18} n/cm^2. It is relatively simple to obtain a very strong perturbation of the lattice with thermal neutrons through the reaction $Li^6(n,\alpha)H^3$. The defects thereby produced in the crystal lattice were investigated x radiographically and optically. From the pattern of the optical absorption, the concentrations of color centers in the irradiated crystal were determined. From an analytical description of the color center formation, the number of lattice defects produced in the crystal could be determined. By comparison with x-ray measurements, the dependence of the lattice constant variation on the Frenkel defect concentrations was obtained. The mean displacement of the nearest neighbors of a Frenkel defect (A = 0.13.... 0.09a) could be determined together with theoretical considerations. Under high irradiation (about 10^{18} n/cm^2) both the lattice constant variation and the optical absorption attain saturation ($\Delta a/a = 2 \times 10^{-3}$) and recovery. Simultaneously with these variations the crystal breaks as a result of the stresses occurring. From the x-ray reflection broadening, the trend could be determined with the neutron dose. The mean crystallite size after irradiation with 10^{18} n/cm^2 was still 4000 Å. The lattice defects produced could be further recovered ty tempering at >400°C. The activation energy was measured at 0.84 ± 0.30 ev, valid for an irradiation temperature from about 50°C. Also the cleavage in the crystal was recovered at higher temperatures (t > 550°C) than the lattice constant modification. (tr-auth)

8906 RADIATION STABILITY OF ION EXCHANGE RESINS. E. D. Kiseleva, K. V. Chmutov, and V. N. Krupnova (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 36: 2457-64(Nov. 1962). (In Russian)

The radiation effect of ion exchange resins depends upon the structure of the micromolecular framework, the chemical nature, the exchange group, the type of crosslinkage and the radiation medium. Both in DVB-styrene copolymers and in phenol-formaldehyde resins the C–R bond (KF-1 and RF resins) was more resistant towards ionizing radiation than the C–S bond (KU-2, KU-1 resins). By changing the structure of the crosslinking component the radiation stability of the ion exchanger may also be changed. The replacement of DVB by butadiene (SBS–2 resin) led to stabilization of the C–S bond. The C–S bond was more stable towards ionizing radiation in phenol-formaldehyde (KU-1) resins than in the sulfonated styrene–DVB copolymer (KU-2). (auth)

8907 RADIATION STABILITY OF ION EXCHANGE RESINS. III. THE EFFECT OF THE IONIZING RADIATION OF AN ACCELERATED ELECTRON FLUX ON ION EXCHANGE RESINS. E. D. Kiseleva, K. V. Chmutov, and N. V. Filatova (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 36: 2465-8(Nov. 1962). (In Russian)

The effect of the ionizing radiation of an accelerated electron flux on the physico-chemical and ion-exchange properties of the anion exchanging resins AV-17, AM, AMP, and VP-1 was investigated. It is shown that irradiation of the anion exchangers AV-17 and AM with a dose of $0.1-1.4.10^{23}$ ev/g causes a fall in weight, exchange capacity, and swelling. The basicity of irradiated AV-17 diminishes as is shown by potentiometric titration, but the anion exchanger remains polyfunctional. It was found that anion exchangers with a pyridine exchange group are resistant towards the ionizing radiation of an accelerated electron flux. (auth)

8908 EFFECT OF SPACE ENVIRONMENT ON PHOTOVOLTAIC CELLS. J. M. Denney, R. G. Downing, and G. W. Simon (Space Technology Labs., Inc., Redondo Beach, Calif.). ARS Preprint No. 2536-62. New York, American Rocket Society, 1962. Prepublication Copy. 7p. $1.00.

Theoretical calculations are performed concerning inelastic nuclear interactions between incident high-energy protons and silicon. The results of these calculations indicate that, above incident proton energies of about 20 Mev, the primary defect production mechanism is inelastic nuclear interactions. Additional evidence is presented that indicates that the defect structures produced by these inelastic nuclear interactions are significantly more complicated than those produced by electron and lower-energy proton-induced elastic nuclear interactions. On the basis of these phenomena, it is shown that high-energy proton experimental damage data on silicon photovoltaic devices obtained at low illumination intensities cannot be applied directly to spacecraft photovoltaic power supply systems designed to operate at the illumination levels existing in space. (auth)

8909 DEISTVIE IZLUCHENII NA IONNYE STRUKTURY. (Radiation Effects on Ionic Structures). B. V. Budylin and A. A. Vorob'ev. Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1962. 168p.

Radiation effects on ionic structures; particle bonds; and optical, dimensional, electrical, mechanical, and thermal properties were studied as well as the changes in properties of oxides and other elements with ionic bonding. (R.V.J.)

8910 SPACE RADIATION EFFECTS ON MATERIALS. ASTM Special Technical Publication No. 330. (American Society for Testing and Materials, Philadelphia). Oct. 1962. 69p. $2.50.

After an outline of the space environment and radiation, radiation effects are studied on metallic, inorganic, ceramic, organic, and semiconductor materials and electronic components. Testing and research methods are outlined. Sources of information (journals, books, proceedings, and index-abstract services) are listed. (T.F.H.)

8911 PROCESS FOR CURING SOLID COMPOSITE PROPELLANTS USING ELECTROMAGNETIC RADIATION. Perry A. Argabright and Irving Kuntz (to Esso Research and Engineering Co.). U. S. Patent 3,070,470. Dec. 25, 1962. Filed Jan. 29, 1958.

A uniform solid propellant rocket fuel is formed by subjecting to gamma radiation a slurry of an unsaturated liquid polymer, an organic polyhydrosulfide, and a major proportion of a strongly oxidizing solid inorganic salt. A rubbery solid fuel is obtained. (R.J.S.)

PHYSICS

General and Miscellaneous

Refer also to abstracts 7675, 7676, 7678, and 9861.

8912 (AD-277042) THE DEVELOPMENT OF AN AUXILIARY ELECTRODE THERMIONIC CONVERTER. Quarterly Technical Report No. 1, January 15, 1962–March 30, 1962. F. G. Block and J. J. O'Grady (Radio Corp. of America. Electron Tube Div., Lancaster, Penna.). Apr. 15, 1962. Contract AF33(657)-8005. 17p.

The efficiency and life expectancy of thermionic energy converters for space applications were studied. The objective of the program is to determine the feasibility and to demonstrate the practicality of a three-electrode thermionic converter having a third, positive ion-producing electrode, an efficiency of not less than 15%; an unattended life of not less than one year; and a maximum temperature of 1500 Kelvin. An approach using impact ionization will be pursued. (auth)

8913 (AD-278170) THEORETICAL STUDY OF GROUND MOTION PRODUCED BY NUCLEAR BLASTS. Final Technical Report. Gabriel Cinelli and Leif Erik Fugelso (American Machine and Foundry Co., Niles, Ill.). Oct. 30, 1959. Contract AF29(601)-1190. 139p. (AFSWC-TR-60-8)

Free-field ground motions for use in the design of underground protective structures are studied. Two-dimensional motion of an elastic half-plane under an exponentially decaying normal load traveling at constant velocity along the boundary is determined analytically and the results are presented graphically. Analytic expressions in integral form are obtained for three-dimensional axisymmetric motion of an initially quiescent homogeneous isotropic elastic half-space under an arbitrary axisymmetric time-dependent normal loading, and these expressions are utilized for the special cases of a concentrated normal point load and a uniform concentrated normal ring load suddenly applied and thereafter maintained at a fixed position on the plane boundary. Analytic expressions in integral form are obtained for the three-dimensional axisymmetric motion of a homogeneous isotropic visco-elastic half-space under identical conditions as for the elastic case. (auth)

8914 (AFCRL-62-475) LABORATORY STUDIES OF ATOMIC AND ELECTRONIC COLLISION PROCESSES RELEVANT TO THE STUDY OF THE UPPER ATMOSPHERE. Final Report. N. P. Carleton (Harvard Univ., Cambridge, Mass.). Apr. 25, 1962. Contract AF 19(604)-4984. 25p. (AD-277166)

Atomic and electronic collision processes related to the study of the upper atmosphere are treated. There is particular emphasis on processes producing visible radiation. The problems studied are in three groups: (1) investigation of excitation by electron, ion, and atom impact; (2) study of reactions which ions and molecules in excited states may undergo; and (3) field study of fluctuations in auroral light. (auth)

8915 (AFCRL-62-628) ABSORPTION SPECTRUM OF YTTERBIUM IN SINGLE CRYSTAL OF CALCIUM FLUORIDE. Technical Note No. 2. W. Low (National Research Council of Canada, Ottawa and Hebrew Univ., Jerusalem). Feb. 1962. Contract AF61(052)-549. 16p. (AD-277007)

High resolution spectrum of Yb^{3+} in the cubic field of CaF_2 is reported. The striking features of the spectrum are two strong sharp lines at 10384.759/cm and 10377.039/cm at 4.2°K. The position of the two lines and their separation was measured as a function of the temperature. The line shape is Lorentzian. The possible position of the various Stark levels of the ground state is discussed. (auth)

8916 (AFCRL-1049) MICROMETEORITE COLLECTION FROM A RECOVERABLE SOUNDING ROCKET. GRD Research Note No. 71. R. K. Soberman, ed. (Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.). Nov. 1961. 52p. (AD-272994)

This report contains three articles regarding the "Venus Flytrap" collector rocket. The first article discusses the experimental details and rocket performance. The second and third articles present the results obtained to date and an interpretation of these results, respectively. (auth)

8917 (AFOSR-1101) THE EFFECT OF RADIATION ON SHOCK VELOCITY. ATTENUATION IN ELECTROMAGNETIC SHOCK TUBES. J. A. Thornton and Ali Bulent Cambel (Northwestern Univ., Evanston, Ill. Gas Dynamics Lab.). Apr. 1961. Contract AF49(638)-879. 55p. (AD-277360)

Observations are reported in a study of effects of radiation on shock velocity attenuation in the conical electromagnetic shock tube. A summary is included of findings which have appeared in the literature along with the approximate blast wave theory, which has become the primary method of making theoretical velocity attenuation calculations. These published observations lead to the question of the effect of radiation on the velocity attenuation in a tube with highly reflective walls such as might be employed in a propulsion system. The approximate blast wave theory is then adapted in developing a modified approximate method for calculating the effect of radiation on shock velocity attenuation. Approximate radiation equations are combined with the velocity attenuation equations and a study is made of factors which might influence the velocity attenuation by radiation. It is concluded that radiation will be an important factor only for strong shocks moving into a dense gas (approximately $^1/_{10}$ atmosphere or greater and room temperature). A description of the electromagnetic shock tube is given, and some of the velocity attenuation experiments which are being conducted are discussed. No attenuation due to radiation has been noted. These experiments conducted at low velocities and densities thus agree with the predictions of the approximate blast wave theory modified to account for radiation effects. (auth)

8918 (BNL-5902) FOURIER PROJECTIONS OF UNPAIRED ELECTRON DENSITIES. S. J. Pickart (Brookhaven National Lab., Upton, N. Y. and Naval Ordnance Lab., White Oak Md). [1961]. Contract [AT (30-2)-Gen-16]. 15p.

The reliability of using Fourier syntheses with data on neutron magnetic scattering by iron to illustrate anisotropy of the unpaired electron distribution is examined. Particular attention is given to diffraction effects that are studied by varying the number of coefficients used in the syntheses. Effects of the resolution function and experimental errors on density patterns obtained are discussed, and various projections are shown. The method is found to give reliable information. (D.W.C.)

8919 (CRNP-1121) LIQUID DYNAMICS FROM NEUTRON SPECTROMETRY. B. N. Brockhouse, J. Bergsma,

B. A. Dasannacharya, and N. K. Pope (Atomic Energy of Canada Ltd., Chalk River, Ont.). Oct. 1962. 27p. (AECL-1576)

Recent experiments carried out at Chalk River on the dynamics of liquids using neutron inelastic scattering are reviewed, including one by Sakamoto et al., in which the Van Hove self-correlation functions in water at 25 and 75°C were determined, and another in which the correlation functions in liquid argon near its triple point were studied. The possible occurrence of short wavelength phonons in classical liquids is discussed, in analogy with their existence in the quantum liquid He^4, and in connection with incomplete experiments on liquid tin. (auth)

8920 (GACD-2461) RECOMBINATION AND ATTACHMENT IN IONIZED GASES. Technical Summary Report, May 1, 1960 through July 31, 1961. V. A. J. van Lint and J. Parez (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Aug. 4, 1961. Contract AF29(601)-2779. 51p.

Modifications on apparatus used in experiments on electron-ion recombination coefficients, attachment rates, and electron collision frequencies are discussed. Experiments performed with the following gases: pure argon, nitrogen, nitrogen dioxide, oxygen, and helium as well as the mixtures nitrogen–oxygen, argon–nitrogen dioxide, and helium–nitrogen dioxide are described and the results evaluated. Representative data are graphed, and future plans are mentioned. (D.C.W.)

8921 (HW-SA-2511) ABSOLUTE MEASUREMENT OF W_{Air} FOR COBALT-60 GAMMA RAY SECONDARIES. H. O. Wyckoff and I. T. Myers (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 27, 1962. Contract [AT(45-1)-1350]. 5p.

It is noted that the average energy required to produce an ion pair in air, usually denoted by W(air), is basic to many measurements of absorbed dose with ionization chambers. An investigation is described in which a free air ionization chamber is used to measure the ionization per unit volume, while the determination of the energy absorption is based on calorimetric measurement. These measurements revealed that the energy required to produce an ion pair in air for the secondary Co^{60} gamma radiation is 33.86 ± 0.33 ev/ip. (J.R.D.)

8922 (JAERI-1037) THEORY OF THE APPLICATION OF ELECTRICAL IONIZATION TO THE MHD POWER GENERATOR. Syukuro Yano and Tatsumi Hiramoto (Japan Atomic Energy Research Inst., Tokyo). 1962. 56p. (In Japanese)

A method of increasing the ionization in MHD power generators by applying momentary electric fields to rare gases at 1000 to 2000°K seeded with low-ionization-potential gases was investigated theoretically. It was found to be theoretically possible to design and construct such generators using the non-equilibrium ionization state that is created by the initial stage of the electric discharge in the short interval between initiation of electric field application to the seeded rare gases and ionization saturation. (J.R.D.)

8923 (JINR-E-1067) CONTINUOUS PLANNING OF REGRESSION EXPERIMENTS. S. N. Sokolov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 15p.

A local-optimal continuous planning of regression experiments is suggested. It is shown that in case of the stable condition of experiment the continuous planning is asymptotically global-optimal. (auth)

8924 (JPL-TR-32-171) A 500-ELECTRICAL-WATT SOLAR ENERGY THERMIONIC CONVERSION SYSTEM FOR A MARS SPACECRAFT. Arvin H. Smith (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). Apr. 15, 1962. Contract NAS 7-100. 14p.

The conceptual design of a solar energy thermionic (SET) conversion system suitable for use as the prime source of electrical power for a Mars spacecraft is described. Two designs of such a system are considered. The most promising design, designated SET (A), would employ an individual, 9.5-ft-diameter, rigid, parabolic mirror to intercept, reflect, and concentrate solar energy. A multidiode thermionic generator would convert the concentrated thermalized solar energy into electricity. SET (A) would utilize a 500-electrical-watt thermionic generator incorporating a cavity-type absorber, cesium-vapor-filled thermionic diodes, heat radiators, temperature-controlled cesium reservoirs, and a solar flux control mechanism. An alternate design, designated SET (B), would incorporate a 5-ft-diameter mirror and a 135-watt thermionic generator. Four such modules would be clustered to provide up to 540 watts of electrical power at Mars (aphelion). The design features of a 135-watt flight prototype, which is currently under active development, are presented. It is concluded that potentially advantageous solar energy thermionic conversion systems are possible, provided that long life and adequate reliability can be achieved. (auth)

8925 (LA-2712) DETONATION PROPERTIES OF CONDENSED EXPLOSIVES CALCULATED WITH AN EQUATION OF STATE BASED ON INTERMOLECULAR POTENTIALS. Wildon Fickett (Los Alamos Scientific Lab., N. Mex.). May 1962. Contract W-7405-eng-36. 176p.

The best available statistical-mechanical theories consistent with a reasonable expenditure of computer time were used to calculate a detonation product equation of state for condensed explosives and were tested by comparison of calculated detonation properties with experiment. Chemical equilibrium among up to nine product species, including a separate solid phase, was assumed. The LJD cell model was the basic equation of state. For application to mixtures, a variant of the Longuet-Higgins conformal solution theory was chosen, although some other forms were also considered. The sensitivity of the results to variation of the uncertain intermolecular potentials and other doubtful elements of the theory was sufficient to rule out an a priori calculation, but rough adjustment of one parameter gave fair agreement with experiment for a variety of CHON explosives. The performance of this theory was comparable to that of simpler forms previously tried. (auth)

8926 (LAMS-2807) THE FIELD OF A MAGNETIC BUBBLE. B. R. Suydam (Los Alamos Scientific Lab., N. Mex.). Nov. 26, 1962. Contract W-7405-eng-36. 7p.

A perfectly conducting sphere is immersed in a uniform magnetic field. If now the sphere is suddenly expanded or collapsed, it will induce motion of the field lines and hence give rise to a radiated signal. The resulting electromagnetic field is computed. (auth)

8927 (NIRL/R/18) THEORY OF TWO-STAGE SEPARATED BEAM SYSTEMS. J. W. Gardner (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England). Aug. 1962. 30p.

The theory of particle separation using electrostatic velocity separators is extended to cover situations involving two stages of separation for unstable particles. The associated quadrupole systems are described by a thin

lens model, and the effects of momentum spread in the beam are included. Separator lengths and total system lengths for optimum transmission of wanted particles in the plane of separation are derived for given physical separation. Under certain conditions, it is shown that momentum spread in the beam may lead to an optimum choice of separator aperture (and corresponding voltage). (auth)

8928 (NP-12325) RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Eleventh Quarterly Progress Report, June 16, 1962 through September 15, 1962. R. Novick (Columbia Univ., New York. Columbia Radiation Lab.). Sept. 15, 1962. Contract DA-36-039-SC-78330. 64p. (CU-9-62-SC-78330 Phys.)

Double photon excitation of the $6S_{1/2}-9D_{3/2}$ transition in atomic cesium was observed when the vapor is illuminated with the intense light of a pulsed ruby laser. These observations provide a simple and direct test of the theory of two photon processes. New values are reported for the spin, magnetic moment, and quadrupole moment of 245-day Zn^{65} and 43-day Cd^{115m}. These results were obtained by optical double resonance. Values of the level crossing fields in 6.7-hour Cd^{107} and 245-day Zn^{65} are reported. A program of solid state research involving a study of the demagnetized state was initiated. The demagnetized state is achieved by adiabatic demagnetization in the rotating frame; it is expected that this technique will be useful in the study of rare spins. Polarization studies at S band were made on a number of radio sources with the NRL radio telescope and a 9.4-cm maser preamplifier. Large polarization was found in Hercules A, 3C 433, and 3C 295. (auth)

8929 (NP-12335) A PRELIMINARY SURVEY OF DEUTERIUM ISOTOPE ABUNDANCE RATIOS IN THE HYDROTHERMAL AREAS OF NEW ZEALAND. J. R. Hulston (New Zealand. Inst. of Nuclear Sciences, Lower Hutt). [1962]. 10p. (INS-R-15)

An investigation of the deuterium variation in a limited number of samples from New Zealand hydrothermal areas was conducted. It was found that sufficient variations occur to show that measurement of O^{18} and deuterium isotopes should yield results which would add to the knowledge of these hydrothermal systems. (J.R.D.)

8930 (NP-12356) FEASIBILITY STUDY TOWARD DEVELOPMENT OF RADIATION RESISTANT SOLAR CELL. Monthly Report, November 1–November 30, 1962. M. D. Cheslow and S. Kaye (Electro-Optical Systems, Inc., Pasadena, Calif.). Dec. 15, 1962. Contract NAS7-92. 11p. (EOS-2080-ML-13)

Theoretical investigations concerning the behavior of graded-base solar cells were conducted. Anomalous results were obtained by computer solutions of the transport equation for semi-infinite base region calculations. In view of these results, the boundary conditions were carefully investigated along with the small signal assumption. Results of these investigations are included. (J.R.D.)

8931 (NP-12389) SPUTTERING YIELDS. Annual Report, November 1, 1961–October 31, 1962. Report No. 2356. G. K. Wehner, R. V. Stuart, and D. Rosenberg (General Mills, Inc., Minneapolis). Nov. 15, 1962. Contract Nonr-1589(15). 73p.

Sputtering yield measurements for various metals under noble gas ion bombardment in the energy range 50 to 600 ev were essentially completed. Results for metals, including some rare earths, under He^+, Ne^+, Ar^+, Kr^+, Xe^+, and Hg^+ bombardment are presented in over 200 yield curves. The spectroscopic technique for measuring sputtering threshold energies is described. This technique was applied to the measurement of the velocity distribution of sputtered atoms by pulsing a target and measuring the transit time of sputtered atoms to an observation point a known distance away from the target. Velocity distributions of atoms sputtered from polycrystalline and single crystal Cu targets are presented. Average velocities were found to be in the range 3 to 10 ev, in good agreement with previous measurements and much higher than those of thermally evaporated atoms. (auth)

8932 (NP-12415) NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period July–September 1962. (Naval Research Lab., Washington, D. C.). Oct. 1, 1962. 88p.

A total of 12 papers is included. Separate abstracts were prepared for 10 of the papers. The two papers for which no abstracts were prepared were concerned with use of a multidetector array and formulation of statistical problems. (J.R.D.)

8933 (NP-12415(p.1-3)) ANALYSIS OF THE REACTION $Li^7(He^3,\alpha)Li^8$. A. R. Knudson and E. A. Wolicki (Naval Research Lab., Washington, D. C.).

It is noted that the gradual variation of the $Li^7(He^3,\alpha)Li^8$ angular distribution is suggestive of a direct interaction mechanism. An analysis of the data obtained at 4.5 Mev in terms of such mechanisms is presented. The reaction modes considered are pick-up, knock-out, and exchange stripping. Results of theoretical calculations are included. (J.R.D.)

8934 (NP-12415(p.7-21)) QUATERNION APPROACH TO ELEMENTARY PARTICLE THEORY. [PART] I. E. J. Schremp (Naval Research Lab., Washington, D. C.).

It is noted that the usual formulation of the Dirac electron theory is given in terms of what is known as a 16-component Clifford algebra. It is also possible to express the same physical theory in terms of a simpler 4-component Clifford algebra of complex 2×2 matrices, or the equivalent algebra of complex quaternions. A discussion is presented in which this expression is examined and applied as the quaternion approach to the theory of elementary particles in general. Other discussion is included concerning isospin and ordinary spin in which a representation of isospin operators is introduced as quaternion right multipliers in complete analogy with the representation of ordinary spin operators as quaternion left multipliers. The quaternion approach toward the treatment of ordinary spin is also developed. (J.R.D.)

8935 (NP-12415(p.22-9)) THE LEE MODEL APPLIED TO THE VIRTUAL DEUTERON. D. W. Joseph and W. W. Wada (Naval Research Lab., Washington, D. C.).

It is noted that in a previous paper the cutoff Lee model was applied to the deuteron. The V-particle was identified with the normal deuteron, and θ particles with the neutron and proton in a ^3S state, near threshold. A discussion is presented in which the N and θ particles are again identified with neutron and proton, but in a ^1S state, while the V-particle is associated with the singlet deuteron. There is in this case no physical V-particle state, because the singlet deuteron is only a virtual particle and not a real one. It is concluded that the Lee model with cutoff can be applied to n-p scattering near the threshold in both the spin-triplet (normal deuteron) and spin-singlet (virtual deuteron) cases. Applications of the Lee model to recently discovered resonances are discussed. (J.R.D.)

8936 (NP-12415(p.30-9)) TRANSFORMATION OF COMPLEX COSMIC-RAY NUCLEI IN GALACTIC SPACE.

M. M. Shapire, B. Hildebrand, et al. (Naval Research Lab., Washington, D. C.).

Results of an investigation involving emulsion stack exposures at an atmospheric depth of 2.7 g/cm^2 at the latitude of Texas are presented. Interpretive comments concerning the data are included. The main conclusion of the study is that the identification of isotopic mass by a single method demands a precise knowledge of the resolution function involved. (J.R.D.)

8937 (NP-12415(p.40-5)) NOTE ON THE BRANCHING RATIO OF THE D-D REACTIONS. R. B. Theus, W. I. McGarry, and L. A. Beach (Naval Research Lab., Washington, D. C.).

It is noted that the transmutation reactions between deuterons are basic in the description of nuclear interaction mechanisms. Measurements of the relative branching ratios in the D-D reactions were made in the past with emulsions or proportional counters. The shortcomings of these methods were overcome by use of solid-state detectors. Such detectors also have the advantage of use in simultaneous detection of both reactions in the same detector, greatly reduced neutron-induced background effects, and well-separated spectral peaks. (J.R.D.)

8938 (NP-12415(p.46-52)) A FISSION PRODUCT MONITOR FOR WATER COOLED REACTORS. C. M. Gordon, J. H. Miller, and R. E. Larson (Naval Research Lab., Washington, D. C.).

Design and testing of an instrument to use Cherenkov radiation from high-energy beta particles emitted by fission products to monitor reactor coolant water are described. The prototype instrument demonstrated adequate sensitivity and relative tolerance to temperature, pressure, and radiation background. (J.R.D.)

8939 (NP-12415(p.55-63)) THE CONVECTIVE AMPLIFIER. D. dePackh (Naval Research Lab., Washington, D. C.).

It is noted that a large class of systems of importance in beam theory can be described by the set of equations $Dx = y$, $Dy = \omega_0^2 x + w$, $DcW = \alpha x - \beta y$. In simple amplifiers the characteristic frequency (ω_0) is constant, while in parametric forms it has a periodic variation with the independent variables. Results of a study are presented in which only the simple amplifier is considered and only forward propagation along the circuit is allowed. Illustrative examples are included. (J.R.D.)

8940 (NP-12415(p.64-78)) A SOLENOID-FOCUSED GUIDE RING FOR THE STORAGE OF AN INTENSE ELECTRON BEAM. Report No. 2. D. dePackh, J. Ehrman, et al. (Naval Research Lab., Washington, D. C.)

Theoretical work since the last report was devoted largely to efforts aimed at obtaining models of the beam which could be used for calculations concerning its collective behavior. A significant breakthrough is noted in the appearance of a collective model of the behavior of a sheet beam. The experimental work consisted principally of designing suitably accurate coil mounts in order to define the optical axis of the ring, designing and winding a set of coils for accurate mounting, development of coil switching electronics, and testing the first 6 ft of the ring. (J.R.D.)

8941 (NP-12415(p.79-85)) THE CONTROL OF FREE TRANSVERSE BEAM OSCILLATIONS THROUGH INVERSE FEEDBACK. D. dePackh (Naval Research Lab., Washington, D. C.).

Aspects of beam control through feedback processes are treated under certain idealized conditions. Factors are suggested which may limit the method. The requirements imposed on the amplifiers which handle the information appear to be severe. Further study of the real beam gain matrix is recommended to determine whether high-frequency losses occur in the beam channel which might justify attempts to extend the amplifier bandwidth. (J.R.D.)

8942 (NP-12415(p.86-8)) ABSORPTION OF THE ENERGY OF FREE TRANSVERSE BEAM OSCILLATIONS BY A RESONANT WALL. D. dePackh (Naval Research Lab., Washington, D. C.).

Aspects of a calculation are examined which is intended to treat the transverse interaction caused by the electric reaction fields in a filamentry electron beam within a partially conducting cylindrical tube, with a general wall in which the conductance per unit length is regarded as a periodic function of longitudinal distance. The beam is considered as captured in a large circular orbit of radius R_0 and moving with constant linear velocity. (J.R.D.)

8943 (NP-12450) STATISTICAL THERMODYNAMICS. Lecture Given by L. Rosenfeld at the Ecole d'Ete de Physique Theorique, Les Houches, July 28–August 28, 1952. (Nordisk Institut for Teoretisk Atomfysik, Copenhagen). 1960. 113p.

Information on statistical thermodynamics is presented in which an atomistic interpretation of heat phenomena is given. In its broadest aspect, the atomistic view of matter and radiation involves regarding these physical agencies as composed of elements, the atoms (or molecules) of matter and the monochromatic waves of electromagnetic radiation, obeying well-defined laws of motion or propagation. Notes and discussion concerning various aspects of the statistics related to thermodynamics are presented in sections on classical statistics, statistics of closed systems, statistics of open system, quantum discription of physical systems, and the ergodic theorem. (J.R.D.)

8944 (NP-12477) HIGH TEMPERATURE THERMOELECTRIC GENERATOR. Fourth Quarterly Progress Report, October 1, 1962–December 31, 1962. C. M. Henderson, R. G. Ault, Emil Beaver, R. J. Janowiecki, H. B. Jankowsky, and L. Reitsma (Monsanto Research Corp. Dayton Labs., Ohio). Contract AF33(657)-7387. 52p.

The experimental model generator completed more than 800 hrs of operation of a substained performance test at a hot end temperature of 1200°C (+25, −0°C), cold end at about 714°C (+12, −0°C) in a vacuum of 10^{-5} mm Hg without degradation of its power producing characteristics. The test is continuing. Progress was made in efforts to improve the properties of high temperature n- and p-type thermoelectric materials needed to supplement p-type MCC 50, the thermoelectric material used in the experimental model generator now under test. Investigations were initiated to develop improved emissive cold-end radiator coatings and methods for fabricating MCC 50 thermoelectric modules. (auth)

8945 (RISO-46) RELAXATION PHENOMENA BEHIND A STRONG SHOCK IN HYDROGEN. II. ATTAINMENT OF THE EQUILIBRIUM DEGREE OF DISSOCIATION. C. T. Chang (Denmark. Atomenergikomissionen. Forsøgsinstitut, Risø). Sept. 1962. 22p.

The overall relaxation distance for the attainment of the equilibrium degree of dissociation of H_2 is calculated for shocks with Mach members (M_s) at 12 to 34 at an initial condition of $P_1 = 0.2$ mm Hg and $T_1 = 300$°K. The results show that at lower M_s (<22), the relaxation distance decreases rapidly as M_s increases. At higher M_s, the relaxation distance varies very little with M_s. (J.R.D.)

8946 (TID-15268) OPTIMIZATION OF EFFICIENCY OF A CESIUM-DIODE CONVERTER. C. K. Sanathanan (Argonne National Lab., Ill.). Jan. 1962. Contract [W-31-109-eng-38]. 11p. (UAC-5993)

The values of the heat-transfer coefficient and effective thermal emissivity of a cesium diode were varied and the effect on efficiency was studied. The efficiency was optimized with respect to the lead wire voltage and the load voltage. Results are presented in graphs. (M.C.G.)

8947 (TID-15543) PROPAGATION OF APPROXIMATION ERRORS IN SPECTRA: THE GAS MODEL. C. N. Kelber and K. S. Min (Argonne National Lab., Ill.). Feb. 1962. Contract [W-31-109-eng-38]. 16p. (UAC-6157)

An approximation error in the scattering kernel of the slowing down equation was investigated. A comparison was made of solutions of the integral equation with solutions of Corngold's higher approximation equations. The problems posed and the modes of solution are outlined, together with the resulting spectra. Data on detector response are summarized. The influence of the assumed source on the propagation of error is discussed. (M.C.G.)

8948 (TID-17398) OPTICAL AND MICROWAVE INVESTIGATIONS OF SOLIDS. E. Burstein (Pennsylvania. Univ., Philadelphia). [nd]. Contract AT(30-1)-2395. 17p.

Infrared equipment was improved. The optical design calculation for the Raman spectrophotometer was completed. Measurements of the I-V curves of a number of thin film superconductor-metal oxide-superconductor tunnel junctions revealed deviations from the usual single particle tunneling curves in the form of excess currents. Investigations of Azbel-Kaner type cyclotron resonance in p-type PbTe yielded detailed information about the valence band structure of PbTe. A theoretical analysis was made of Azbel-Kaner cyclotron resonance in semiconductors in which the cyclotron orbit of the carriers was not large compared to the skin depth. Studies were made of the magnetoresistance of nickel and its interpretation in terms of the structure of the Fermi surface. Well-resolved Azbel-Kaner cyclotron resonance was observed in gold. The valence band structure of Bi_2Te_3 was investigated by means of deHaas-van Alphen oscillations. (M.C.G.)

8949 (TID-17787) FEASIBILITY OF A LIQUID HELIUM SPARK CHAMBER. D. Cohen (Argonne National Lab., Ill.). Sept. 18, 1962. Contract [W-31-109-eng-38].

A study was conducted to evaluate the feasibility of a liquid helium spark chamber. The experimental work on electrical breakdown in liquid helium is reviewed, and a crude mechanism for the breakdown is described. It is concluded that a liquid helium spark chamber probably is not feasible for two reasons: (1) Breakdown occurred owing to cathode activity and not to radiation ionization. (2) The drifting ions in liquid helium do not have sufficient energy to produce ionization. (D.L.C.)

8950 (UCRL-6731) ARE CURL-FREE FIELDS NECESSARY IN GUIDED-WAVE THEORY? Bernard A. Lippmann (California. Univ., Livermore. Lawrence Radiation Lab.). Jan. 5, 1962. Contract W-7405-eng-48. 9p.

The use of longitudinal fields in the theory of guided waves is discussed. (auth)

8951 (UCRL-6795-T) A CALCULATIONAL METHOD TO DETERMINE GAMMA HEATING IN INFINITE SOURCE MEDIA. Alex Lorenz (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 16, 1962. Contract W-7405-eng-48. 4p.

A time-independent technique to calculate gamma energy deposition in materials composing an infinite homogeneous medium containing a uniform source was developed to study trends in nuclear heating. The cross section input is used in the code for calculating probabilities of events or branching ratios, and energy down-scatter. These quantities are used to determine the allocation of the photon energies of a specified source spectrum to the constituent elements of the medium. A single problem is run in a few seconds on the IBM 7090 computer. (J.R.D.)

8952 (UCRL-6809(Rev. 1)) EMISSION CHARACTERISTICS OF TANTALUM, TUNGSTEN, RHENIUM, AND IRIDIUM IN PLASMA DIODES. W. H. Gust (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 2, 1962. Contract W-7405-eng-48. 18p.

Experimental determinations of the ionic and electronic emission characteristics of tantalum, tungsten, rhenium, and iridium cathodes in vapor thermionic converters are compared. It is shown that tantalum provides superior thermal ionization qualities at high pressure compared with tungsten, rhenium, and iridium. High electronic current densities may be obtained from cesium on rhenium and cesium on iridium at much lower cesium vapor pressures than for tantalum or tungsten. (auth)

8953 (UCRL-10466) MECHANISM OF GASEOUS PERMEATION THROUGH GLASS, SINGLE-CRYSTAL SILICON, AND GERMANIUM; AND STRESS-ENHANCED GASEOUS PERMEATION THROUGH ALUMINA BODIES (thesis). Perry Louis Studt (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 26, 1962. Contract W-7405-eng-48. 138p.

This study consists of two parts. The first part is a development of a more fundamental and quantitative understanding of the transport of noble gas atoms through glasses and single-crystal Si and Ge. Literature pertinent to gaseous permeation through these materials is reviewed with respect to experimental data and explanations for the observed permeations. A series of equations for the permeation coefficient is developed in terms of the solubility coefficient and diffusion coefficient. The theory is further extended for Si and Ge to include calculation of the activation energy for diffusion and solution. From this resulting quantitative theory, it is possible to explain the relationship of glass modifiers to permeability, and the increase in density with increasing amounts of glass modifiers up to about 10 mol percent, and to identify the forces probably responsible for the observed activation energies for diffusion and solution. The second part consists of an investigation of the effect of induced stresses on permeation through normally impermeable high-purity Al_2O_3 bodies. Stress-enhanced permeation is found and related to the microstructure of these bodies. Adsorption of helium on internal surfaces of these bodies is also found as well as initial stress-free permeability for specimens that later become impermeable. The permeability found is considered to be significantly different from that discussed for glass and single-crystal silicon and germanium. (auth)

8954 (UCRL-10510) THE RANDOM-PHASE APPROXIMATION APPLIED TO ATOMIC STRUCTURE (thesis). Philip L. Altick (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 15, 1962. Contract W-7405-eng-48. 84p.

The random-phase approximation, developed in the study of the electron gas, was used as a framework for the calculation of atomic excitation energies, oscillator strengths, and photo-ionization cross sections. Numerical results were obtained for the $^1P^0$ states of beryllium, magnesium, calcium, zinc, and strontium. Excitation energies and oscillator strengths are presented for the three or four lowest discrete states. The cross sections are given in the energy range from 0.005 to 0.245, 0.405, or 0.605 atomic units above threshold, depending on the atom. It is found that the electron correlations cause a substantial improvement in the lowest-lying, "resonance," excitation energy,

and oscillator strength, but their effect decreases rapidly with high excitation energy. The photo-ionization cross sections near threshold are greatly enhanced by the correlations, excepting beryllium, and are much larger than the experimental values for magnesium and calcium; however, the computed cross section is of the right order of magnitude for strontium. The disagreements are attributed to auto-ionization effects. (auth)

8955 (SCL-T-459) CREATION OF D.O.P. MISTIC BODIES AND THEIR REMOVAL. Yoshitoshi Oyama, Yoichi Takashima, and Hisashi Mikami. Translated by Noburu Hiraga (Sandia Corp., Albuquerque, N. Mex.) from Rika Gaku Kenkyusho Hokoku, 34: 330-8(Sept. 1958). 18p.

Experiments were carried out on the creation and removal of submicron dioctyl phthalate (DOP) mistic particles. A La-Mer Sinclair-type producer was used to create the DOP particles, and the methods used to measure the particle diameter and concentration are described. The effects of the production conditions on the particle diameter were studied. Efficiency tests were carried out on three Toyo filters, three AEC filters, and a millipore filter. The best performance was shown by AEC H-64, which however gave efficiencies (~97%) less than the claimed figure of 99.9%. A pilot plant for the complete elimination of mistic bodies was built, and preliminary results are given. (D.L.C.)

8956 (UCRL-Trans-832(L)) HEAT MOTION IN SOLIDS AND LIQUIDS. J. Frenkel. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore) from Z. Physik, 35: 652-69(1926). 22p.

Heat motion of atoms in solid crystalline bodies is analyzed on the basis of Jaffe's conception of partial dissociation, and characterized through probabilities which relate to dissociation of the atom, its displacement in the interlattice space, and recombination with empty places. Heat motion in liquids is identified with the motion of dissociated atoms in crystals. By application of Stokes law to liquid atoms, the viscosity coefficient of simple liquids such as Hg is calculated. (J.R.D.)

8957 THE SPACE-TIME CORRELATION FUNCTION FOR A SYSTEM OF IDENTICAL PARTICLES AT ZERO TEMPERATURE. D. Kisdi (Research Group for Theoretical Physics, Hungarian Academy of Sciences, Budapest). Acta Phys. Acad. Sci. Hung., 15: 49-56(1962). (In English)

The ground state space-time correlation function is calculated for both boson and fermion systems, by using the Bogoliubov canonical transformation technique. The method employed is valid for fluids exhibiting quantum degeneracy, such as He II. (auth)

8958 DECAY AND BUILD-UP OF LUMINESCENCE OF ZnS: Cu, Cl. Toshio Yoshida. Ann. Rept. Radiation Center Osaka Prefect., 2: 78-84(1961). (In English)

Measurements are reported for the luminescence build-up and decay in cubic and hexagonal ZnS activated with 0 to 0.01 wt % Cu. The numerical values of rise and decay times are tabulated, and the spectral distributions of the samples are plotted for times of 26 to 700 msec after excitation. It was found that the samples with rapid luminescence rise also had rapid decay, the luminescence of cubic samples builds up or decays faster than that of hexagonal samples with an equal concentration of Cu, and the luminescence build-up and decay are faster on the shorter wavelength side. (D.L.C.)

8959 A NOTE ON THE MAXIMUM CRITICAL FIELD OF HIGH-FIELD SUPERCONDUCTORS. B. S. Chandrasekhar (Westinghouse Research Labs., Pittsburgh). Appl. Phys. Letters, 1: 7-8(Sept. 1962).

The maximum field at which a superconductor maintains superconductivity is recognized as a parameter of the superconductor, and an attempt is made to find a relation between maximum field and critical temperature. A rough proportionality is graphically displayed for Nb_3Sn, Nb–Zr, Nb–Ti, and Mo_3Re. Emphasis is given to the effect of the magnetic field on the electron spin. (D.C.W.)

8960 STIMULATED EMISSION OF ULTRAVIOLET RADIATION FROM GADOLINIUM-ACTIVATED GLASS. H. W. Gandy and R. J. Ginther (Naval Research Lab., Washington, D. C.). Appl. Phys. Letters, 1: 25-7(Sept. 1962).

All known laser materials emit in either the red or infrared regions, but stimulated ultraviolet emission from a Gd^{3+}-activated silicate glass at a wavelength of 3125 Å is now reported. The host glass was of Li–Mg–Al–SiO_3 composition, and samples were melted in reducing and oxidizing atmospheres. Stimulated emission apparently results from an optical transition from the $P_{\frac{7}{2}}^{6}$ state to the $S_{\frac{7}{2}}^{8}$ ground state of the $4f^7$ electronic configuration of Gd^{3+}, absorptions from the ground state to the levels in the I^6 multiplet being the transitions causing excitation of the emission. (D.C.W.)

8961 PHYSICS OF THE ATMOSPHERE AND SPACE. Francis S. Johnson (Southwest Center for Advanced Studies, Dallas). Astronautics, 7: No. 11, 72-5(Nov. 1962).

Data collected during the past year deal with solar ultraviolet radiation, trapped radiation, radio whistler propagation, geomagnetism, topside ionospheric soundings, and high-energy ionospheric electrons. New findings are discussed, and a new U. S. Standard Atmosphere is reported to cover the altitude region up to 700 km. 34 references. (D.C.W.)

8962 MAGNETOHYDRODYNAMICS. Edwin L. Resler, Jr. (Cornell Univ., Ithaca, N. Y.). Astronautics, 7: No. 11, 146-8(Nov. 1962).

A short review of the theory that makes power generation seem feasible is given in a discussion of problems met in accelerating or decelerating electrically conducting gas streams by electromagnetic means. (D.C.W.)

8963 DIFFUSION LENGTH MEASUREMENT BY MEANS OF IONIZING RADIATION. W. Rosenzweig. Bell System Tech. J., 41: 1573-88(Sept. 1962).

Penetrating radiation in the form of high-energy electrons, heavy particles, and gamma rays may be used to determine minority-carrier diffusion lengths in semiconductor materials containing junctions, by measuring the radiation-induced short-circuit current. The electron-beam method yields an accurate absolute determination of diffusion length once the carrier-generation rate as a function of depth in the material is measured. A series of such experiments is described for silicon solar cells utilizing electrons ranging in energy from 0.61 to 1.16 Mev. A resultant maximum generation rate of $2.25 \times 10^6 \pm 5$ per cent carriers/cm/incident 1-Mev electron is obtained at a depth of 0.096 g/cm^2. Measurements with 16.8- and 130-Mev protons and Co^{60} gamma rays are found to be in agreement with the electron-beam measurements. An experimental arrangement is described that yields rapid and accurate diffusion-length measurements of solar cells under conditions in which radiation damage is negligible. (auth)

8964 THE PRINCIPLE OF INCREASE OF ENTROPY FOR SPIN OPERATORS. K. Urbanik (Inst. of Mathematics,

Polish Academy of Sciences, and Univ. of Wrocław). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 10: 349-52(1962). (In English)

The behavior of the entropy of moving physical systems is studied. A theorem is proved concerning the limiting value of the entropy connected with a spin-component operator as the time approaches infinity. (T.F.H.)

8965 ESTABLISHMENT OF PARAMAGNETIC SALT EQUATIONS AND RE-ANALYSIS OF HELIUM ISOTHERMS BY THE METHOD OF MULTIPLE VARIABLE LEAST SQUARES. T. R. Roberts, S. G. Sydoriak, and R. H. Sherman (Los Alamos Scientific Lab., N. Mex.). Bull. Inst. Intern. Froid, Annex, 115-23(1961). (LADC-4889)

Deming's method of least squares adjustment of experimental data where two or more variables are in error is described, and an example of the use of the method is given. The method is used to compute the magnetic exchange interaction term for paramagnetic thermometry using chromic methylammonium alum and ferric ammonium alum, and to reanalyze Keller's He^3 and He^4 isotherms for the third virial coefficient. (D.L.C.)

8966 ABSORPTION SPECTRA OF MONOCRYSTALS IN THE FAR INFRARED (50 TO 1600 μ) AT THE TEMPERATURE OF LIQUID HELIUM: CESIUM IODIDE, QUARTZ, GERMANIUM, AND NEODYMIUM NITRATE. Armand Hadni, Jacques Claudel, Edmond Décamps, Xavier Gerbaux, and Pierre Strimer (Institut de Physique, Faculté des Sciences, Nancy). Compt. Rend., 255: 1595-7(Oct. 1, 1962). (In French)

The absorption spectra of the crystals studied undergo spectacular modifications at very low temperatures. The low-frequency planes of the lattice vibrations almost completely disappear. On the contrary, in other cases, new transitions are shown, and the possibility of observing electron transitions, even in the very far infrared, is not excluded. (tr-auth)

8967 SINGULARITIES OF IONIZED ELECTRIC FIELDS. Noël Félici (Institut Fourier, Grenoble, France). Compt. Rend., 255: 1703-5(Oct. 8, 1962). (In French)

The integration of the equation of ionized fields causes the appearance of singularities which show a "pinching" or, on the contrary, a "hollowing" of the space charge accompanied by profound deformations of the field. These results, in complete opposition to the "approximate solutions" accepted at the present, show the physical importance of non-linear equations. (tr-auth)

8968 SUPERCONDUCTIVITY OF CADMIUM ISOTOPES. J. L. Olsen (Eidgenössische Technische Hochschule, Zurich). Cryogenics, 2: 356-8(Dec. 1962).

The isotope effect in the superconductivity of cadmium has been measured. $\alpha = 0.51 \pm 0.10$ in the relation $T_c M^{\alpha} =$ constant. (auth)

8969 AN APPARATUS FOR OBTAINING TEMPERATURES DOWN TO 0.3°K USING HELIUM-3. B. N. Esel'son, A. D. Shvets, and N. G. Bereznyak (Physico-Technical Inst., Ukrainian Academy of Sciences, USSR). Cryogenics, 2: 361-2(Dec. 1962).

The construction and characteristics of an apparatus for obtaining temperatures down to 0.3°K by pumping the vapor off liquid He^3 are described. The main differences from the known cryostats of this type lie in the use of a charcoal adsorption pump instead of a rotary oil pump, and in the cooling by He^3 of a bath with a liquid mixture of He^3 and He^4 which appreciably increases the time of operation of the arrangement in comparison with the use of liquid He^4 for this purpose. (auth)

8970 REACTIVE COLLISIONS IN CROSSED MOLECULAR BEAMS. Dudley R. Herschbach (Univ. of California, Berkeley). Discussions Faraday Soc., No. 33, 149-61(1962). (UCRL-10096)

The distribution of velocity vectors of reaction products is discussed with emphasis on the restrictions imposed by the conservation laws. The recoil velocity that carries the products away from the center of mass shows how the energy of reaction is divided between internal excitation and translation. Similarly, the angular distributions, as viewed from the center of mass, reflect the partitioning of the total angular momentum between angular momenta of individual molecules and orbital angular momentum associated with their relative motion. Crossed-beam studies of several reactions of the type M + RI — R + MI are described, where M = K, Rb, Cs, and R = CH_3, C_2H_5, etc. The results show that most of the energy of reaction goes into internal excitation of the products and that the angular distribution is quite anisotropic, with most of the MI recoiling backward (and R forward) with respect to the incoming K beam. (auth)

8971 A STUDY OF THE MÖSSBAUER EFFECT IN TIN COMPOUNDS. V. I. Gol'danskii, G. M. Gorodinskii, S. V. Karyagin, L. A. Korytko, L. M. Krizhanskii, E. F. Makarov, I. P. Suzdalev, and V. V. Khrapov (Inst. of Chemical Physics, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 147: 127-30(Nov. 1, 1962). (In Russian)

The effect of electron shell structure on the energy of recoil-less gamma transitions has been followed in compounds of quadrivalent tin. Compounds of β-tin metal and of SnO_2 (whose chemical shift with respect to β-tin metal is 2.7 mm/sec) were used as sources of the 23.8-kev γ quanta of Sn^{119m}. The velocity of the adsorber with respect to the source varied uniformly from 0 to 15 mm/sec (in units of 0.07 mm/sec), and from 15 to 30 mm/sec (in units of 0.14 mm/sec). Singlet, Mössbauer spectra were observed in the "symmetrical" compounds $SnCl_4$, $SnBr_4$, SnI_4, $Sn(C_6H_5)_4$, and SnO_2. The energy of the gamma transition decreases linearly with increasing electronegativity of X in the SnX_4 compound (X = a halide), and with increasing ionic character of the Sn–X bond of tetravalent tin. The magnitude of the chemical shift for the gamma transition of Sn^{119} is determined by the following general relationship: $\delta = 1.6 \times 10^{-29} [|\Psi_s(0)|^2_{abs} - |\Psi_s(0)|^2_{emit}] (\Delta R/R)$ ev. Here $|\Psi_s(0)|^2$ is the density of S-electrons in the region of Sn^{119} nucleus, and $\Delta R = R_{exc} - R_0$ is the difference in radii of the Sn^{119} nucleus in the excited state (R_{exc}) and in the ground state (R_0). With completely ionic bonding, it is found that $\delta_{ion} = -5.6$ mm/sec $= -4.4 \times 10^{-7}$ ev. The value of $\Delta R/R$ is $+1.9 \times 10^{-4}$. Strong, asymmetrical, doublet splitting was observed in compounds of the type Ph_3SnX (where Ph is a phenyl group, and X is a halide), and in SnF_4. (TTT)

8972 SOURCE OF PULSED IONS OF THE HIGH FREQUENCY TYPE. Takashi Tsuchimoto and Eiichi Hara (Hitachi Central Research Lab., Tokyo). Japan J. Appl. Phys., 1: 358-62(Dec. 1962). (In French)

A mesh grid is introduced to a high-frequency ion source for the production of a pulsed ion beam, and the characteristics of mesh grid potential vs. ion beam current show that there is a remote cutoff potential 1.2 kv above the probe potential. The beam output current can be gradually and continuously changed by changing the potential of the mesh grid. The obtained pulsed-beam figures are detected by using magnetic pick-up probes of the pulse-transformer type. The cause of the remote cutoff is also discussed. (auth)

8973 HIGH-FIELD SUPERCONDUCTING PROPERTIES OF Ti–Mo ALLOYS. R. R. Hake and D. H. Leslie (Atomics International, Canoga Park, Calif.). J. Appl. Phys., 34: 270-6(Feb. 1963).

Critical current densities J_c for restoration of detectable resistance have been measured for superconducting Ti–Mo alloys at 1.2°K in steady magnetic fields up to 30 kG, and for approximate Mo concentrations of 6, 9, and 16 at. %. Cold rolling is observed to increase the J_c values considerably and, in the case of Ti-16 at. % Mo, to result in a marked "anisotropy" of J_c similar to that observed in many other cold rolled alloy superconductors: at high fields J_c is essentially a maximum or minimum when the applied transverse magnetic field ($H \perp J$) is, respectively, parallel or perpendicular to the rolling plane, apparently independent of specimen geometry. This suggests that J_c is very sensitive to the relative orientation of the field and an anisotropic defect structure normally introduced during cold rolling. The J_c anisotropy does not appear to be critically dependent upon the angle between the current and the rolling direction for current directions in the rolling plane and can apparently be suppressed by martensitic transformation during cold rolling. Although an explanation of J_c anisotropy in cold-worked alloys does not fall within the scope of homogeneous alloy-negative surface energy theories, the "upper" resistive critical fields [$H_r(J = 1\ A/cm^2)$] for these alloys, ranging from 26.5 to 64 kG, are in fair agreement with predictions of the Ginzburg-Landau-Gor'kov-Abrikosov theory. (auth)

8974 EFFECTS OF GLASS CONTAMINATION AND ELECTRODE CURVATURE ON ELECTRICAL BREAKDOWN IN VACUUM. E. E. Donaldson and M. Rabinowitz (Washington State Univ., Pullman). J. Appl. Phys., 34: 319-22(Feb. 1963). (TID-17043)

It has recently been found that particles of contamination reside on surfaces inside vacuum systems as a result of thermal decomposition of glass. These particles contain at least Na, K, and B as well as traces of Al and Si. They may well have been important in many clean surface experiments. Our investigation has shown that these particles have a strong influence in reducing the breakdown voltage in vacuum. Breakdown voltages for Al, Cu, and stainless steel electrodes with radii of curvature of 12.7, 25.4, 50.8, and 101.6 mm were determined under clean and contaminated conditions at 10^{-5} Torr. It was found that under clean conditions the electrodes of smaller radii of curvature have higher breakdown voltages than the more nearly plane electrodes. (auth)

8975 MOBILITIES OF THE ALKALI METAL IONS IN THEIR OWN VAPOR. John W. Sheldon (National Aeronautics and Space Administration, Cleveland). J. Appl. Phys., 34: 444(Feb. 1963).

The mobilities of Cs, Rb, K, and Na ions were calculated for low applied electric fields using several sets of recently reported charge-exchange cross section data. The data, reported for ion-atom relative energies between 6 and 10,000 ev, were extrapolated down to a relative energy of 0.01 ev. (W.D.M.)

8976 COMPARISON OF RADIAL DISTRIBUTION FUNCTIONS FROM INTEGRAL EQUATIONS AND MONTE CARLO. A. A. Broyles, S. U. Chung, and H. L. Sahlin (Univ. of Florida, Gainesville). J. Chem. Phys., 37: 2462-9(Nov. 15, 1962).

The radial distribution functions g for a system of particles interacting with the Lennard-Jones 6-12 potential were found by solving the Percus-Yevick (PY) equation, convolution approximation or hypernetted chain equation (CHNC), and the Born-Green-Yvon (BGY) equation, for four particle densities previously investigated by Monte Carlo (MC) techniques. The thermodynamic quantities p/nkT, E/NkT, and nkTK were also computed from the g's. A comparison showed that the PY quantities agree best with MC, CHNC quantities agree next best, and BGY agree most poorly, particularly at high densities. A comparison of nkTK computed by differentiating p/nkT and by direct integration involving g gives approximately consistent results for the PY g but not for the CHNC g. The asymptotic form of g for high densities for the PY and CHNC equations is found to agree with that obtained by Kirkwood. (auth)

8977 HELIUM ATOM: A FIFTH-ORDER WAVE-FUNCTION. Robert E. Knight and Charles W. Scherr (Univ. of Texas, Austin). J. Chem. Phys., 37: 2503-4 (Nov. 15, 1962).

An extension of calculations through ϵ_{11} via Ψ_5 is reported. The series truncated at this point suffices to furnish an accurate eigenvalue for the helium atom case, $E(2,2) = -2.9037\ 2425$ au. The successive ϵ_i have the appearance of converging toward a ratio of the coefficients of about +0.75. If this is assumed, the series may be extrapolated to give $E(2,2) = -2.9037\ 2434$ au. (P.C.H.)

8978 LOW-ENERGY COLLISION CROSS SECTIONS OF H^- AND OH^- IONS IN OXYGEN. C. E. Baker, J. M. McGuire, and E. E. Muschlitz, Jr. (Univ. of Florida, Gainesville). J. Chem. Phys., 37: 2571-4(Dec. 1, 1962).

Elastic and inelastic collision cross sections were measured for collisions of H^- and OH^- ions in oxygen gas in the energy range 4-350 ev. An approved collision chamber was used for the measurements. The majority of the inelastic collisions in the case of OH^- were apparently due to electron detachment, but in the case of H^-, charge exchange or an ion-molecule reaction or both predominate, particularly at the low energies. In the range 4-26 ev the interaction potential derived from the elastic scattering of OH^- in O_2 was $V(ev) = -18.4/r^{5.34}$(r in Å). The large amount of inelastic scattering observed for H^- in O_2 precluded an accurate determination of the interaction potential in this case. The electrons produced in electron-detachment collisions of negative ions are shown to have energies considerably in excess of thermal energy. (auth)

8979 CHARGE EXCHANGE BETWEEN GASEOUS IONS AND ATOMS. Donald Rapp and W. E. Francis (Lockheed Missiles and Space Co., Palo Alto, Calif.). J. Chem. Phys., 37: 2631-45(Dec. 1, 1962).

A calculation of symmetric resonant charge exchange cross sections was made for a selection of atoms in the velocity range where the impact parameter method is applicable. Cross sections for other atoms can be estimated by interpolating in terms of their ionization potentials. The results are in fair agreement with experiment. A similar calculation was attempted for asymmetric nonresonant charge exchange processes. The approximations used are more restrictive in this calculation, the calculations being only semiquantitative in nature. The cross section of an asymmetric charge exchange process was determined in terms of the ΔE of the reaction and the average ionization potential of the two atoms. The results are qualitatively in agreement with experiment. A very brief discussion of approaches for extrapolating data to lower velocities, where the rectilinear orbit impact parameter method is not applicable, is given. (auth)

8980 OCCURRENCE OF H_3^+ IN THE FIELD IONIZATION OF HYDROGEN. T. C. Clements and E. W. Mueller (Pennsylvania State Univ., University Park). J. Chem. Phys., 37: 2684-7(Dec. 1, 1962).

Mass-spectroscopical analysis of the ions produced at a point emitter with dynamic supply of hydrogen at room temperature or in modified field ion microscopes at 78 and 20°K showed the abundant occurrence of H_3^+ besides H^+ and H_2^+. The triatomic molecule ion is formed only in the narrow range of field strength near best image conditions. The mechanism of H_3^+ formation under the extreme field conditions is uncertain. Field ion-microscopic observation shows H_3^+ only over single protruding surface atoms, which might act as sites for deactivation of an intermediate state, or simply provide a region of locally enhanced field to allow quick field ionization of short-lived H_3. (auth)

8981 ELECTRICAL CONDUCTION IN NONSTOICHIOMETRIC α-Nb_2O_5. R. F. Janninck and D. H. Whitmore (Northwestern Univ., Evanston, Ill.). J. Chem. Phys., 37: 2750-4(Dec. 15, 1962).

The electrical conductivity of nonstoichiometric α-Nb_2O_{5-x} was measured as a function of both the composition over the range $0.001 \leq x \leq 0.137$ and the temperature from 77 to 1270°K. The temperature dependence of the conductivity of a specimen of fixed oxygen content may be rationalized on the basis of excitation of electrons from donor centers at low temperatures and an exhaustion region at high temperatures. The conductivity data are interpreted in terms of an oxygen ion vacancy defect capable of trapping two electrons which can be thermally excited into a narrow 4d conduction band. Assuming this type of defect, an estimate of the mobility of the electrons in the conduction band is made from the conductivity data in the exhaustion region. (auth)

8982 FLUORESCENCE SPECTRA AND LIFETIMES OF SOME RARE-EARTH COMPOUNDS. Foster F. Rieke and Rinda Allison (Univ. of Chicago). J. Chem. Phys., 37: 3011-12(Dec. 15, 1962).

Measurements of the fluorescence lifetimes were made at 25°C, 0°C, and 77°K for terbium trianthranilate and europium tris-dibenzoylmethide, and at 25°C and 77°K for the terbium and europium chlorides. The lifetimes for the chelates were found to be more than twice as long as these for the corresponding chlorides. The fluorescence spectra of the chelates were also compared with these of the chlorides. (D.L.C.)

8983 STANDING CAPILLARY-GRAVITY WAVES OF FINITE AMPLITUDE. Paul Concus (Univ. of California, Berkeley). J. Fluid Mech., 14: 568-76(Dec. 1962). (UCRL-10208)

Standing surface waves in an inviscid incompressible fluid of finite depth are considered, taking into account the effect of capillary forces. Perturbation solutions for the surface profile, velocity potential, frequency of oscillation, and pressure are found to third order in the amplitude of the waves. A graph is given showing the regions in which the frequency of oscillation increases with amplitude and those in which it decreases with amplitude. These regions are defined as a function of the depth of the fluid and a parameter called the relative capillarity. A graph is also given showing the surface profile of a wave. (auth)

8984 EXPLORER 10 MAGNETIC FIELD MEASUREMENTS. J. P. Heppner, N. F. Ness, C. S. Scearce, and T. L. Skillman (National Aeronautics and Space Administration, Greenbelt, Md.). J. Geophys. Res., 68: 1-46 (Jan. 1, 1963).

Magnetic field measurements made by means of Explorer 10 over geocentric distances of 1.8 to 42.6R_e on March 25-27, 1961, are presented. Results from the MIT plasma experiment on the same satellite are referenced in interpretations. The close-in data are consistent with the existence of a very weak ring current below 3R_e along the trajectory, but alternative explanations for the field deviations are possible. Between 8 and 22R_e the existence of a large-scale field directed away from the sun and earth within the geomagnetic cavity on the evening side of the earth is demonstrated. At distances greater than 22R_e and before a storm sudden commencement late in the flight the geomagnetic cavity boundary apparently crossed the satellite trajectory on six principal occasions. Interpretations bearing on the form and boundary conditions of the cavity and solar-interplanetary fields external to the cavity are treated. Correlations with magnetic variations at the earth's surface are noted under quiet magnetic conditions as well as at the time of the sc. These indicate that changes in the solar wind have a direct influence on surface magnetic activity associated with changes in the structure of the cavity. (auth)

8985 THE DEVELOPMENT OF THE MAIN PHASE OF MAGNETIC STORMS. S.-I. Akasofu (Univ. of Alaska, College) and S. Chapman. J. Geophys. Res., 68: 125-9 (Jan. 1, 1963).

The development of the main phase and of auroral activities during magnetic storms is examined for a number of storms. It varies much more than a mere difference of pressure of the solar streams would seem to produce. Some intrinsic differences between solar streams are suggested. (auth)

8986 ON MAGNETOSPHERIC INTERCHANGE INSTABILITY. B. U. Ö. Sonnerup and M. J. Laird (Cornell Univ., Ithaca, N. Y.). J. Geophys. Res., 68: 131-9(Jan. 1, 1963).

Gold has pointed out that the gas in the magnetosphere of the earth can take part in large-scale motions in which tubes of force of equal flux and the gas within them are interchanged. Such motions leave the magnetic field and its energy almost unchanged, and may therefore be driven by variation in the state of the gas. The stability of the magnetosphere against such motion occurring spontaneously is studied by investigation of the change in potential energy of the system during a hypothetical interchange of two tubes of force. For isothermal interchanges the energy criterion may be cast into a useful form without further physical assumptions. The analysis shows that, except possibly at low latitudes, such motions are not of importance. The more realistic case of adiabatic interchanges is discussed in the two limits where the gravitational energy is much smaller or much larger, in absolute value, than the internal energy of the gas. Smaller gravitational energy applies to the outer tubes of force for which the energy content is dominated by the internal energy of the fully ionized hot gas residing far out in the geomagnetic field; spontaneous interchanges occur only if the energy content of the tubes of force decreases sufficiently rapidly in the outward direction. Larger gravitational energy applies to the inner tubes of force since the energy content of these tubes is dominated by the gravitational energy of the cold gas at the feet of the tubes of force, i.e., the ionospheric material. It is shown that spontaneous adiabatic interchanges may occur if the temperature in the upper ionosphere increases sufficiently rapidly with increasing latitude. It is also demonstrated that the temperature gradients in subauroral latitudes, caused by the heating of the ionosphere in the auroral zones by fast particles, may be sufficient to trigger this instability. Thus an inner convective zone may exist in the magnetosphere. The size and location of this zone are discussed. (auth)

8987 GEOMETRICAL HYDROMAGNETICS. J. Bazer and J. Hurley (New York Univ., New York). J. Geophys. Res., 68: 147-74(Jan. 1, 1963).

The propagation of small disturbances in an infinitely conducting, perfect, compressible medium is studied from the standpoint of geometrical hydromagnetics. The medium need not be homogeneous. A wavelike time-harmonic disturbance is assumed given on an arbitrary reference surface. Then the various phase fronts, slow, Alfvén, and fast, that may be thought to evolve out of this surface are obtained as solutions of first-order partial differential equations. These eikonal-like equations are solved, as in optics, by means of rays, which are shown to satisfy Hamilton's equations and Fermat's principle. The hydromagnetic analog of Huygens' phase front construction is described. Next, the variation of the disturbance strengths along the rays is determined in terms of the disturbance strengths on the reference surface, to complete the geometrical solution. A noteworthy feature of this solution is that its component modes of propagation, slow, Alfvén, and fast, are uncoupled as long as the medium is free of diffracting objects and surfaces of discontinuity. As an illustration of the general theory, the complete geometric solution for the propagation of Alfvén disturbances in a dipole field is described with the aid of explicit formulas. Fast wave propagation in various types of inhomogeneous magnetic fields is also briefly discussed. Finally, the problem of reflection and refraction of slow, Alfvén, and fast disturbances at (possibly curved) surfaces of discontinuity is treated. The hydromagnetic analogs of Snell's laws are derived, and their relation to Huygens' wavelet construction is elucidated. It is shown that the introduction of an appropriate set of direction angles for the unperturbed magnetic field (on each side of the discontinuity) (1) reveals the symmetries of 'Snell's laws,' (2) leads immediately to a simplification of V. C. A. Ferraro's laws relating to the reflection and refraction of Alfvén waves, and (3) makes possible a simple graphical method for determining the angles and speeds at which the various reflected and refracted waves emerge. (auth)

8988 AURORAL DISSOCIATION OF MOLECULAR OXYGEN IN THE POLAR MESOSPHERE. Kaichi Maeda (National Aeronautics and Space Administration, Greenbelt, Md.). J. Geophys. Res., 68: 185-97(Jan. 1, 1963).

As has been shown by Kellogg, one of the most effective mechanisms for heating of the polar mesosphere during polar night is the exothermic association of atomic oxygen intensified by the large-scale subsidence of the upper polar atmosphere in winter. Since photodissociation is no longer predominant in the polar regions in winter, the contribution of auroral particles to the dissociation of molecular oxygen is estimated, assuming the atmospheric composition given by Johnson. It is shown that the maximum rate coefficient is of the order of 10^{-8} $(cm^3\ sec)^{-1}$ for protons and electrons of energy spectrum $E^{-n}dE$, where $n \geq 3$, and that the height of maximum dissociation is around 90 km. Consequently, the rate of corpuscular dissociation of oxygen molecules in the upper mesosphere during strong auroral activities is comparable with that of photodissociations, which is mostly due to the Schumann-Runge continuum of solar ultraviolet radiations. (auth)

8989 MEASUREMENT AND INTERPRETATION OF ION DENSITY DISTRIBUTIONS IN THE DAYTIME F REGION. R. C. Sagalyn (Air Force Cambridge Research Labs., Bedford, Mass.), M. Smiddy, and J. Wisnia. J. Geophys. Res., 68: 199-211(Jan. 1, 1963).

The results of measurement of positive ions to an altitude of 520 km with two spherical electrostatic analyzers mounted on a Thor rocket launched at 1300 hours local time are presented. The experimental results obtained below the F_2 peak agree to within 20% with simultaneous ionosonde data. Assuming that thermodynamic equilibrium exists above the F_2 peak, the ion scale height is calculated to be 155 ± 10 km and the ion temperature is found equal to 1300 ± 50°K. A theoretical charge distribution was calculated assuming electrons to be produced by photoionization and destroyed by dissociative recombination of NO^+, N_2^+, O_2^+, and by radiative recombination. Recent experimentally determined values of ion composition, photoionization rates, and dissociative recombination coefficients were used in solving the continuity equation. Excellent agreement is found between the experimental and theoretical charge distributions in the region 150 to 520 km. The altitude of maximum density was measured to be 315 km, the theoretical calculation gives 320 km; the magnitudes differ by a constant factor of 1.4 to 2.0, depending on the values chosen for the dissociative recombination coefficients. Dissociative recombination is found to be the principal electron loss mechanism to 520 km. The theory of measurement of positive ions by means of two-electrode spherical electrostatic analyzer is derived for the case of a Maxwellian gas where (a) the vehicle velocity is variable with respect to the most probable ion velocity, and (b) the mean free path is large compared to the dimensions of the analyzer. (auth)

8990 EXCESS XENON 129 IN CHONDRULES FROM THE BRUDERHEIM METEORITE. Craig M. Merrihue (Univ. of California, Berkeley). J. Geophys. Res., 68: 325-30(Jan. 1, 1963).

The isotopic compositions of xenon from troilite and from chondrules from the Bruderheim meteorite were studied. The troilite is depleted in xenon relative to the total meteorite and has a negligible Xe^{129} anomaly, suggesting a very low iodine content. The chondrules are depleted in xenon of normal composition but show an enrichment of anomalous Xe^{129} by a factor of 2.9. In one gas fraction from these chondrules, the Xe^{129}/Xe^{132} ratio reached 9.6, a new high for this quantity. The wide variations in Xe^{129}/Xe^{132} within this meteorite are further evidence for in situ decay of I^{129}. These data are discussed in the light of the recent suggestion by Wood that chondrules are primitive material which condensed from cooling gases during the formation of the solar nebula. Unusually large anomalies in Xe^{124} and Xe^{126} from the chondrules are tentatively attributed to cosmic irradiation. (auth)

8991 NUCLEAR BURST EFFECTS ON LONG-DISTANCE HIGH-FREQUENCY CIRCUITS. D. Davidson (Deco Electronics, Cambridge, Mass.). J. Geophys. Res., 68: 331-4(Jan. 1, 1963).

In anticipation of the US high-altitude nuclear burst series in the Pacific, recordings were made at Lexington, Mass., of the field strength of Radio Australia on 11.71 Mc/s over a period of several months commencing on April 26, 1962, and ending on Aug. 9, 1962. Effects of the Johnston Island high-altitude shot are shown. (W.D.M.)

8992 EFFECT OF NUCLEAR DETONATION ON THE GEOMAGNETIC FIELD AT PALO ALTO, CALIFORNIA. Sheldon Breiner (Varian Associates, Palo Alto, Calif.). J. Geophys. Res., 68: 335-7(Jan. 1, 1963).

On July 9, 1962, shortly after 0900 UT, the US detonated a nuclear device in the megaton range at an altitude of over 200 miles near Johnston Island. The shot caused a very large perturbation on the normal magnetic field of the earth for at least six minutes immediately after the detonation.

This change was recorded by two model X-4936 rubidium vapor magnetometers in Palo Alto, Calif. The character and general magnitude of the oscillations are shown. (W.D.M.)

8993 EXPERIMENTAL TESTS FOR THE ACCELERATION OF TRAPPED PARTICLES. Richard Kaufmann (Kirtland Air Force Base, N. Mex.). J. Geophys. Res., 68: 371-86(Jan. 15, 1963).

Mechanisms that could result in the acceleration of charged particles within the magnetosphere are discussed in terms of the responses expected from experimental instruments as they pass through acceleration regions. A series of experimental tests is outlined that can determine whether acceleration of trapped particles is important. The mechanisms discussed include Fermi acceleration, which can accelerate protons to tens or hundreds of kilovolts and can increase the energy of trapped electrons several hundred-fold before they are lost in the dense atmosphere. A change in the intensity of the solar wind or of the strength of a ring current can change the energy of trapped particles owing to the betatron mechanism. Electrons can be accelerated to kilovolt energies by the setting up of plasma oscillations or by acceleration within moving clouds or intrusions of solar plasma. Finally, particles can be accelerated to energies of ten kilovolts or more in the vicinity of neutral lines. (auth)

8994 A PULSATING AURORAL-ZONE X-RAY EVENT IN THE 100-SECOND PERIOD RANGE. D. S. Evans (Univ. of California, Berkeley). J. Geophys. Res., 68: 395-400 (Jan. 15, 1963).

The observation of a 100-second periodicity in x-ray intensity at balloon altitudes during an intense auroral-zone x-ray event is described. The peaks in x-ray intensity are attributed to variations in the flux of electrons incident on the atmosphere rather than to motion effect of the electron precipitation. As such, the variations of the electron flux reflect the dynamics of the mechanism responsible for the precipitation of the electrons into the atmosphere. The relation of this type of periodic electron bombardment to pulsating aurora is considered. (auth)

8995 ARTIFICIAL HEATING OF THE ELECTRONS IN THE F REGION OF THE IONOSPHERE. D. T. Farley, Jr. (National Bureau of Standards, Boulder, Colo.). J. Geophys. Res., 68: 401-13(Jan. 15, 1963).

The possibility of artificially heating the electrons in the F region by means of a radio wave is investigated. On the basis of a somewhat oversimplified model of the actual problem, equations are derived for the steady-state values of the electron density and electron temperature profiles as a function of the transmitter parameters and the initial state of the ionosphere. These equations are then solved numerically for several cases of interest. At a frequency of 50 Mc/s, slight but probably detectable changes in the ionosphere could be produced by means of a large antenna and an average transmitter power of the order of 500 kw or more. At higher frequencies, or for smaller average powers, the effects are negligible. Thus heating is unlikely to complicate incoherent scattering measurements in the F region. By using frequencies very near the F-region penetration frequency, however, it is possible to achieve much larger effects because of the resonant absorption. Using only 50-100 kw and a sufficiently large antenna we could change the electron temperature by a few hundred degrees. Using higher powers, much larger changes are possible. Detailed measurements of the heating effects could provide considerable data on transport phenomena in the ionospheric plasma. The experiment would also provide a convenient way of studying a nonequilibrium plasma under fairly controlled conditions. (auth)

8996 GEOMAGNETIC AND SOLAR DATA. J. Virginia Lincoln, ed. (National Bureau of Standards, Boulder, Colo.). J. Geophys. Res., 68: 581-5(Jan. 15, 1963).

Sudden commencements and solar flare effects are given for the second quarter of 1962. Principal magnetic storms for the third quarter of 1962 are listed. (W.D.M.)

8997 PHOTOMETRIC OBSERVATION OF AN ARTIFICIAL AURORA. Samuel H. Neff (Univ. of Canterbury, Christchurch, New Zealand). J. Geophys. Res., 68: 587-8(Jan. 15, 1963).

On July 9, 1962, at 9h 00m 09s GMT the US detonated a nuclear device about 200 miles above Johnston Island. Data are given for an airglow photometer in operation at Christchurch, which recorded the intensities of the OI emissions, λ5577 and λ6300; and N_2^+ emission, λ4278, during the display. (W.D.M.)

8998 ON THE GAUGE COVARIANCE OF QUANTUM ELECTRODYNAMICS. I. Bialynicki-Birula (Univ. of Warsaw). J. Math. Phys. (N. Y.), 3: 1094-8(Nov.–Dec. 1962).

The gauge covariant formulation of quantum electrodynamics investigated. The method used is that of functional integration. This method provides a direct relation between the gauge condition in classical and quantum theories. All results are derived without any reference to the canonical formalism. The same procedure can be applied to the Yang-Mills field with or without a mass, leading in both cases to a renormalizable theory. The Landau gauge is studied in some detail and it is shown that in the perturbation expansion of the propagators no terms violating the gauge invariance appear. Finally, an interpretation of the generalized Ward identity is proposed. (auth)

8999 ON THE RESTRICTED LORENTZ GROUP AND GROUPS HOMOMORPHICALLY RELATED TO IT. A. J. Macfarlane (Univ. of Rochester, N. Y.). J. Math. Phys. (N. Y.), 3: 1116-29(Nov.-Dec. 1962). (NYO-10229)

A study is made of the real restricted Lorentz group, L, and of its relationship to the group, SL(2C), of complex unimodular two-dimensional matrices, and to the group, O_3, of orthogonal transformations in a complex space of three dimensions. The discussion of SL(2C) gives important formulas in concise forms and their proofs in an elegant and economical manner, it deals with the nontrivial matter of proving the internal consistency of the formalism. To illustrate the practical utility of the theory, the product of two nonparallel pure Lorentz transformations is studied. In the discussion of O_3, explicit formulas realizing the isomorphism of O_3 and L are obtained. These formulas are applied, for illustrative purposes, to the derivation of the transformation properties under L of the electromagnetic field vectors, regarded as a complex three-vector (E + iH). A result analogous to the factorization of the general element of L into a spatial rotation and a pure Lorentz transformation, and to the polar decomposition of the general element of SL(2C), is derived for O_3. Insight into the relationship of O_3 to L is provided by considering the unimodular matrix description of the complex Lorentz group, and the contrasting specializations of it, which lead to the unimodular matrix descriptions of its subgroups, O_3 and L. (auth)

9000 STUDIES IN PERTURBATION THEORY. V. SOME ASPECTS ON THE EXACT SELF-CONSISTENT FIELD THEORY. Per-Olov Loewdin (Univ. of Uppsala

and Univ. of Florida, Gainesville). J. Math. Phys. (N. Y.), 3: 1171-84(Nov.–Dec. 1962).

The independent-particle model in the theory of many-particle systems is studied by means of the self-consistent-field (SCF) idea. After a review of the characteristic features of the Hartree and Hartree-Fock schemes, an extension of the SCF method is refined by introducing the exact reaction operator containing all correlation effects. This operator is simply defined by means of the partitioning technique, and, if the SCF potentials are derived from this operator, a formalism is obtained that is completely analogous to the Hartree scheme, but that renders the exact energy and the exact wave function. A derivation of the linked-cluster theorem is given, and the inclusion of various symmetry properties is discussed. (auth)

9001 ON A FUNCTIONAL AVERAGING METHOD IN THE CLASSICAL ENSEMBLE THEORY. A. Galindo (New York Univ., New York and Junta de Energia Nuclear, Madrid). J. Math. Phys. (N. Y.), 3: 1185-90(Nov.–Dec. 1962).

Albertoni, Bocchieri, and Loinger (ABL) (J. Math. Phys. 1: 244(1960)) give a general prescription to calculate the average $E(F)$ of functionals $F[\rho]$ defined on the space $\mathcal{F}$ of the initial states (Liouville density functions) $\rho(x)$ of an arbitrary (finite) dynamical system (S, Σ, μ, H). They then prove that $E(B_H) = 0$ for any $B \in \Sigma$, where B_H is a defined function of ρ alone [ABL theorem]. They claim that E gives the same weight to each $\rho \in \mathcal{F}$, and they therefore, contend that their theorem is sufficient to justify the classical statistical mechanics. The following statements, however, are proved: if (S, Σ, μ, H) is ergodic with discrete spectrum, then for every probability measure ν in $\mathcal{F}$ for which $B_H[\rho] = 0$, almost all of ν (for any $B \in \Sigma$) must be concentrated at $e[e(x) \equiv \mu^{-1}(S)$ on S]; and given (S, Σ, μ, H_0) with $H_0 = 0$, every (normally defined) functional average $A(F)$ such that $A(B_{H_0}) = 0$ for any $B \in \Sigma$ must define a probability measure ν in $\mathcal{F}$ such that $\nu(\{e\}) = 1$. From the latter statementit follows that the ABL average $E(F)$ does not give the same weight to each $\rho \in \mathcal{F}$, because E defines a probability measure in $\mathcal{F}$ concentrated at e; consequently, no significant nontrivial conclusion can be naturally drawn from the ABL theorem regarding the foundations of the classical statistical mechanics. Further, it is impossible to restore in general the validity of the ABL theorem by choosing a different normal functional averaging method. To illustrate this impossibility, a new (nonconcentrated) functional average $E^*(F)$ is introduced and it is proved that $E^*(B_H) \neq 0$ for every nonweakly mixing system (S, Σ, μ, H) and some $B \in H$. (auth)

9002 THEORY OF TRANSPORT COEFFICIENTS. III. QUANTUM STATISTICAL SYSTEMS. S. Fujita (Université Libre, Brussels). J. Math. Phys. (N. Y.), 3: 1246-50(Nov.–Dec. 1962).

The electrical conductivity of an electron-phonon system is calculated using a perturbation method, on the assumption that the coupling is weak, that the system is infinitely large, that the electrons do not interact between themselves and obey the Fermi-Dirac statistics, and that phonons are in thermodynamic equilibrium. The result is identical with that which would be obtained from the Boltzmann-Bloch equation. The calculation is an extension of treatment assuming that the electrons obey the Boltzmann statistics. The relation between the calculation and the derivation of a master equation is critically discussed. A sketch is given for the calculation of the viscosity coefficient of a dilute quantum statistical gas. (auth)

9003 NUMERICAL ESTIMATION OF THE PARTITION FUNCTION IN QUANTUM STATISTICS. Lloyd D. Fosdick (Univ. of Illinois, Urbana). J. Math. Phys. (N. Y.), 3: 1251-64(Nov.–Dec. 1962).

A method for estimating the partition function of a quantum mechanical system is described. The method is based on a technique for evaluating the Wiener integrals, in terms of which the partition function may be expressed. This technique involves an approximation of the Wiener integral by an n-dimensional integral, and a Monte Carlo estimation of the value of the n-dimensional integral. Application of the method to a harmonic oscillator and a pair of interacting particles in a box in two dimensions is described. (auth)

9004 APPROXIMATE SOLUTIONS OF THE MODIFIED BLOCH EQUATIONS FOR LOW MAGNETIC FIELDS. Richard J. Runge (California Research Corp., La Habra). J. Math. Phys. (N. Y.), 3: 1267-77(Nov.–Dec. 1962).

A set of modified Bloch equations for the description of the time dependence of the magnetic moment expectation value in low magnetic fields, is solved using two approximate methods. The equations are solved approximately for the steady state with a constant field and linearly polarized radio-frequency field applied, and an error analysis of the approximate solution is given. A low-harmonic solution is developed and alternative numerical integration techniques are given. Results are exhibited for the low-field electron paramagnetic resonance in anthracene negative ion solution and asphaltene. The methods developed are applicable to a wide range of frequencies, applied field strengths, and ratios of transverse to longitudinal relaxation times. (auth)

9005 GREEN'S DISTRIBUTIONS AND THE CAUCHY PROBLEM FOR THE MULTI-MASS KLEIN-GORDON OPERATOR. John Judson Bowman (Univ. of Michigan, Ann Arbor) and Joseph David Harris. J. Math. Phys. (N. Y.), 3: 1281-90(Nov.–Dec. 1962).

Explicit forms of the Green's functions (which are to be regarded as types of distributions) for the multi-mass Klein-Gordon operator in n-dimensional spaces are presented. The homogeneous Green's functions $G_N(x)$ and $G_N^1(x)$, defined by independent paths of integration in the k_0 plane, are investigated in the neighborhood of the light cone. The parameter N indicates the total number of masses involved. The singularities on the light cone reflect the difference between even- and odd-dimensional wave propagation. It is found that $G_N(x;$ odd n) contains a finite jump on the light cone as well as a linear combination of derivatives up to order $\frac{1}{2}(n-2N-1)$ of $\delta(x^2)$; the singular part of $G_N^1(x;$ odd n) consists of a logarithmic singularity $\ln(|x^2|)$ along with a polynomial in $(x^2)^{-1}$ of degree $\frac{1}{2}(n-2N-1)$. For even-dimensional spaces, the singular part of both Green's functions consists of a polynomial in $(x^2)^{-\frac{1}{2}}$ of degree $n-2N+1$ vanishing outside the light cone for G_N and vanishing inside the light cone for G_N^1. In all cases no singularities or finite jumps occur when the order 2N of the operator is greater than the number n + 1 of space-time dimensions. The general solution of the Cauchy problem is given both for the data-carrying surface t = 0 and for arbitrary spacelike data surface. (auth)

9006 HARTREE-FOCK THEORY FOR A SEMI-INFINITE MEDIUM. M. A. Naqvi and Saifuddin (Atomic Energy Centre, Lahore, West Pakistan). J. Nat. Sci. Math., 2: 62-72(Oct. 1962).

A systematic method for introducing surface corrections to the Fermi-Thomas statistical theory was previously developed. This method has been reexamined and an alternative formulation found which makes several generalizations possible. An outline of the new approach is presented. In the previous work a simplifying assumption

was made on the form of the density matrix, the purpose of the present paper is to examine how sensitively its conclusions depend on this assumption. It is found that, qualitatively, the conclusions of the previous paper on the role and magnitude of the Weizsäcker do not depend too much on this assumption. (auth)

9007 TITHERIDGE COEFFICIENTS FOR THE POLYNOMIAL METHOD OF DEDUCING ELECTRON DENSITY PROFILES FROM IONOGRAMS. Audrey R. Long and J. O. Thomas (Cambridge Univ., Eng.). J. Res. Natl. Bur. Stds., D, 67: 79-82(Jan.-Feb. 1963).

Sets of polynomial coefficients suitable for the conversion into electron density profiles of smooth virtual-height frequency curves, such as those observed regularly at night, are presented for a series of values of the magnetic dip angle and gyrofrequency. These magnetic conditions are chosen so that the coefficients are suitable for the analysis, to a reasonable degree of accuracy, of ordinary and extraordinary ray records obtained anywhere in the world. The coefficients may be used for the analysis of topside-sounder data to a first order of accuracy if the plasma frequency at the satellite is small. (auth)

9008 THERMAL IONIC GENERATOR—POWER GENERATING EQUIPMENT OF THE FUTURE. Sheng Hsi. K'o Hsueh Ta Chung, No. 7, 220-2(1961).

Discussion is given on the thermionic generator, which converts heat energy directly into electrical energy. The principle of operation is the same as that of a diode electron tube. Thermionic generators with vaporized cesium have much higher efficiency than vacuum generators. They can be operated directly with an atomic reactor or a thermonuclear reaction without being contaminated by radiation. Applications of the thermionic generator are also discussed. It is believed that practical thermionic generators will eventually be developed. (P.C.H.)

9009 NUCLEAR EXPLOSIONS IN SPACE. S. F. Singer (Univ. of Maryland, College Park). Nature, 196: 307-14(Oct. 27, 1962).

The effects of nuclear explosions in space are discussed. Possible injection mechanisms are discussed including the injection of electrons from the β decay of fission fragments, injection of electrons from the β decay of slow neutrons from nuclear reactors as well as from bombs, and injection of ~10-Mev protons from fusion neutrons. The removal of naturally trapped particles by space sweeping and by hydromagnetic waves is described. (L.T.W.)

9010 RADIATION ENHANCEMENT FOLLOWING JOHNSTON ISLAND THERMONUCLEAR EXPLOSION. P. J. Edwards (Univ. of Tasmania, Hobart, Australia), A. G. Fenton, K. B. Fenton, J. G. Greenhill, and N. R. Parsons. Nature, 196: 367(Oct. 27, 1962).

An observation made at Hobart, Tasmania, of an enhancement in the counting rate of a balloon-borne Geiger counter at the time of the high-altitude thermonuclear explosion above Johnston Island on July 9, 1962, is reported. Significant features of the event are the considerable atmospheric depth at which it was observed, the delay of between 20 and 30 sec between the instant of the explosion and the commencement of the enhancement, and the peak intensity (averaged over 10-sec intervals) of about 50% above the normal background level near the Pfotzer maximum of the cosmic-ray transition curve. (L.T.W.)

9011 NEW ZEALAND OBSERVATIONS OF THE HIGH-ALTITUDE EXPLOSION OF JULY 9 AT JOHNSTON ISLAND. J. B. Gregory. Nature 196: 508-12 (Nov. 10, 1962)

The principal observations in New Zealand of geomagnetic and atmospheric effects of the explosion of July 9 over Johnston Island are summarized. Outstanding features of the explosion were the intensity of the effects, which caused off-scale readings on many instruments, and evidence for the precipitation of particles over an area extending about 25° farther south than the magnetic conjugate point. (L.T.W.)

9012 EFFECTS OF REABSORPTION ON THE LUMINESCENCE DECAY LAW OF ANTHRACENE CRYSTAL. M. D. Galanin, Yu. V. Konobeev, and Z. A. Chizhikova. Opt. Spectr. (USSR) (English Transl.), 13: 214-16(Sept. 1962).

The luminescence decay of anthracene crystal under γ- and photoexcitation is measured by the method of reflecting pulses in shorted lines. It is shown that the decay is nonexponential. A decay law that takes the effects of reabsorption and secondary luminescence into consideration is derived on a theoretical basis. The deviations from the exponents that are observed experimentally agree qualitatively with those anticipated from the theory. (auth)

9013 COLORING OF PHOTOSENSITIVE GLASSES BY X-RADIATION. V. A. Borgman and V. G. Chistoserdov. Opt. Spectr. (USSR) (English Transl.), 13: 233-5(Sept. 1962).

Absorption bands created in photosensitive glasses at various temperatures by x radiation, and the changes of these bands under heat treatment, are studied. The effect of temperature on the sensitivity to irradiation, and the role of impurity color centers, in the formation of a latent image are established. (auth)

9014 THE SOLUTION OF THE RADIATION-TRANSFER EQUATION FOR THE CASE WHEN THE INDICATRIX OF SCATTERING GREATLY DIFFERS FROM THE SPHERICAL ONE. [PART] I. L. M. Romanova. Opt. Spectr. (USSR) (English Transl.), 13: 238-41(Sept. 1962).

A numerical method is proposed for solving the radiation transfer equation for a plane layer in the case of a scattering indicatrix having a strongly extended forward lobe. The solution proves to have the form of the low-angle approximation to the transfer equation and corrections to this approximation. The integro-differential equation for the corrections leads, by the introduction of discrete ordinates, to a system of ordinary differential equations, at which point a quadrature formula is used, with weights depending on the scattering indicatrix. The system of differential equations is solved by the method of finite differences. The method is on a high-speed computer. (auth)

9015 CORRECTION OF X-RAY SPECTRA FOR SYMMETRIC DISTORTION. V. P. Sachenko and I. Ya. Nikoforov. Opt. Spectr. (USSR) (English Transl.), 13: 247-9(Sept. 1962).

A method is proposed to correct x-ray spectra for symmetric distortion. The method may also be suitable for asymmetric distortion. The procedure for finding the optimum approximation is generalized to the case of arbitrary form. (auth)

9016 THE INFLUENCE OF A MAGNETIC FIELD ON THE TRANSPORT PROPERTIES OF DIATOMIC MOLECULES IN THE GASEOUS STATE. J. J. M. Beenakker, G. Scoles, H. F. P. Knaap, and R. M. Jonkman (Kamerlingh Onnes Lab., Leiden). Phys. Letters, 2: 5-6(Aug. 1, 1962). (In English)

Preliminary measurements were performed on the

change in viscosity of N_2 up to 21 kO_e at pressures of 12.2 and 5.4 mm Hg. The observed effect indicates that a magnetic field influences the transport properties of nearly all diatomic gases and is not limited to paramagnetic gases as was previously supposed. (H.D.R.)

9017 ON THE USE OF GREEN FUNCTIONS IN THE THEORY OF THE ISING FERROMAGNET. B. G. S. Doman (Westfield Coll., London) and D. Ter Haar. Phys. Letters, 2: 15-16(Aug. 1, 1962). (In English)

An application of the double-time temperature dependent Green function method to the Ising model of ferromagnets is presented. The method is found to be a powerful one in statistical mechanics and enables the investigation of higher approximations. (H.D.R.)

9018 ON THE PARTIAL PERSISTENCE OF SUPERCONDUCTIVITY AT VERY HIGH MAGNETIC FIELDS AND CURRENT DENSITIES. C. J. Gorter (Kamerlingh Onnes Lab., Leiden). Phys. Letters, 2: 26-7(Aug. 1, 1962). (In English)

The partial persistence of superconductivity in metal films is analyzed for magnetic fields considerably higher than the thermodynamically calculated critical field and at high transverse current densities. A spatial modulation of the difference in free energy between the normal and super-conductive phases is formulated and shown to give a reasonable description of the general character of the anomalous superconductive behavior of some alloys. (H.D.R.)

9019 EXCITATION TRANSFER IN THE CESIUM–NITROGEN SYSTEM. L. Allen and O. S. Heavens (Univ. of London). Phys. Letters, 2: 35-7(Aug. 1, 1962). (In English)

The feasibility of using a cesium–nitrogen mixture as a maser material has been examined because of a close correspondence in two of their energy levels. For maser action to occur it is necessary to ensure an inversion of population between an excited and a lower state. Transition probabilities are tabulated for all transitions up to the 9d ^2D level of cesium. These transitions are examined for the necessary conditions to be fulfilled in order that a population inversion occur, and the conditions for maser action are discussed. (H.D.R.)

9020 RADIATION-INDUCED TRANSPORT OF MAGNETIC FLUX ALONG A SUPERCONDUCTING SHEET. J. F. Marchand and J. Volger (Philips Research Labs., Eindhoven, Netherlands). Phys. Letters, 2: 118-19(Sept. 1, 1962). (In English)

A switching phenomenon based on the formation of a spot of normal conductivity by shining a ray of light upon a superconducting film is discussed. Possible applications of this switching process as a modulator for d-c amplifier circuits, as a radiation switch to recouple transformer coils, and for the transport of magnetic flux trapped in such a spot are examined. (H.D.R.)

9021 MEASUREMENTS ON TWO Nb SUPERCONDUCTIVE RF CAVITIES. L. Rinderer (Université, Lausanne, Switzerland), J. Ruefenacht, and A. Susini. Phys. Letters, 2: 119-20(Sept. 1, 1962). (In English)

The r-f properties of two Nb cavities tuned to 270 Mc/s were measured. The two mechanically identical cavities were of the capacity-loaded coaxial type and were made of sintered Nb 99.98% pure. One was unannealed and the other annealed at 1200°C for 1 hour. The quality factor Q was measured by the 3 db method up to a current of 8 ma. In the unannealed cavity the Q was independent of current. In the annealed cavity the Q decreased with increasing current. Internal and external stresses and surface roughness are thought to have a harmful influence on the quality factor. (H.D.R.)

9022 EVIDENCE FOR FOCUSED RECOIL TRAJECTORIES FROM A HIGH-ENERGY SPUTTERING EXPERIMENT WITH Cu. R. S. Nelson and M. W. Thompson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Letters, 2: 124-6(Sept. 1, 1962). (In English)

The {110} face of a copper crystal was bombarded with 25, 50, and 75 kev Ar ions, and the relative densities of ejected Cu atoms on a collector plate were determined. The number of atoms ejected in a particular direction relative to the number in the (110) direction was calculated, and the number ejected into the {111} streaks were observed to increase at higher recoil energies. The observed increase of streak intensity with recoil energy suggests that the streaks are evidence of focused recoil trajectories. (H.D.R.)

9023 EQUIVALENCE BETWEEN THE $\hbar \to 0$ LIMIT OF THE CLASSICAL "WELLENBILD" AND THE HYDRODYNAMICAL THEORY OF SUPERCONDUCTIVITY. P. Bocchieri and A. Loinger (Università, Pavia, Italy and Instituto Nazionale di Fisica Nucleare, Milan). Phys. Letters, 2: 137-8(Sept. 1, 1962). (In English)

The classical hydrodynamical equations of a charged nonviscous fluid, supplemented by an equation of London, are shown to be equivalent to the equations obtained from the classical Schrödinger-Maxwell "Wellenbild," taking the limit corresponding to the "geometrical optics" approximation ($\hbar \to 0$). (H.D.R.)

9024 A STUDY BY STATIC MAGNETIC TECHNIQUES OF RUTILE SINGLE CRYSTALS AFTER VARIOUS EXTERNAL TREATMENTS. K. G. Srivastava (Allahabad Univ., India). Phys. Letters, 2: 143-4(Sept. 1, 1962). (In English)

Several rutile single crystals were prepared by x-irradiation, fast thermal quenching from 1000 to −183°C, slow (200-kv) electron bombardment, neutron bombardment, and about 1% reduction. Very brief results from conduction mechanism measurements made by static magnetic techniques are reported on all but the neutron-irradiated and reduced samples. (H.D.R.)

9025 MAGNETIC INTERACTION IN EuS, EuSe, AND EuTe. S. Van Houten (N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Phys. Letters, 2: 215-16(Oct. 1, 1962). (In English)

The preparation, crystal structure, and magnetic properties of EuS, EuSe, and EuTe are described. The lattice parameters, Curie points, effective moments, and saturation moments are tabulated, and the magnetic susceptibility is shown as a function of temperature. EuS and EuSe are found to be purely ferromagnetic insulating compounds with Curie points of 16 and 6°K, respectively. EuTe is probably weakly antiferromagnetic with an asymptotic Curie point of −5°K and a Néel temperature of about 6°K. (H.D.R.)

9026 A COMPLETE NON-RELATIVISTIC TREATMENT OF THE H_2 MOLECULE. W. Kolos (Univ. of Chicago) and L. Wolniewicz. Phys. Letters, 2: 222-3(Oct. 1, 1962). (In English)

The coupling between electronic and nuclear motions in the theory of molecular structure is taken into account by employing the complete hamiltonian of the system and computing by a variational method a wave function depending on the relative coordinates of all the particles involved. In this way one gets directly the energy of the zeroth vi-

brational level, the observable dissociation energy D_0, of the molecule. The wave function can be employed to compute expectation values of those operators that depend explicitly on the internuclear distance R. This method was adopted for calculations involving the hydrogen molecule. Theoretical and experimental values of D_0, the expectation value of the internuclear distance, and the inverse square root of the expectation values of R^{-2} are tabulated for the ground state of the H_2 molecule. (H.D.R.)

9027 IONIC CONTRIBUTION TO FIELD GRADIENTS IN THE RARE EARTHS. E. G. Wikner (General Atomic Div., General Dynamics Corp., San Diego, Calif.) and G. Burns. Phys. Letters, 2: 225-7(Oct. 1, 1962). (In English)

The antishielding factors, γ_∞, for the rare earth ions Pr^{3+} and Tm^{3+} for which Hartree (H) wave functions are available are calculated. They are used to estimate γ_∞'s for other rare earth ions, and from these factors the lattice contribution to the quadrupole coupling for several lattices is found. These results are applied in determining the size of the ionic contribution. The method of calculating the field gradient q circumvents the need of a lattice summation and is based on determining the crystalline field parameters $\langle r^n \rangle A_n^m$ from optical data. (H.D.R.)

9028 ON THERMAL-DIFFUSION-COLUMN-SHAPE FACTORS FOR A GAS OF MOLECULES WITH AN INVERSE POWER POTENTIAL. G. Reinhold and G. Vojta (Arbeitsstelle für Statistische Physik der Deutschen Akademie der Wissenschaften, Berlin, Leipzig). Phys. Letters, 2: 230-3(Oct. 1, 1962). (In English)

The considerations presented are based on the theory of the thermal diffusion column for the cylindrical or extreme cylindrical case developed by Furry and Jones. The essential quantities in that theory are the column constants H, K_c, and K_d; only the case of the Maxwellian molecules was treated explicitly. A preliminary report is presented on a generalization for molecules with an intermolecular force proportional to $1/R^\nu$, where R is the intermolecular separation. A parameter n is defined by the relation $\nu = (2n + 3)/(2n - 1)$, and calculations are performed to define the shape factors h, k_c, and k_d. The values of k_d are tabulated for n = 1, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{2}{5}$, and $\frac{1}{2}$. (H.D.R.)

9029 ON THE PHASE SEPARATION IN THE LIQUID SYSTEM $Ne-nD_2$. M. Simon (Université, Brussels). Phys. Letters, 2: 234(Oct. 1, 1962). (In English)

The liquid system $Ne-nD_2$ presents large departures of thermodynamic properties from ideality. The total vapor pressure, the condensation pressure, and the second virial coefficient of the gases were measured for the system at 24.56°K, and a pressure versus composition diagram is presented. The curve indicates a separation of the solution into two liquid phases in the concentration range 26 to 85% of neon. The excess free energy and the upper critical point are evaluated and found to be in reasonable agreement with theory. (H.D.R.)

9030 EFFECT OF SMALL IMPURITIES ON THE SUPERCONDUCTING TRANSITION TEMPERATURE. D. S. Kothari, V. S. Mathur, and N. Panchapakesan (Univ. of Delhi). Phys. Letters, 2: 235-6(Oct. 1, 1962). (In English)

An investigation is presented on the significance of the Cooper pair idea to the understanding of superconductors with dilute impurities. Calculations are shown for estimating the change in superconducting transition temperature (T_c) for a pair of finite momentum. The change in transition temperature depends only on the mean free path and is independent of the nature of impurities determining the free path or the nature of the superconductor. It is concluded that very thin films may correspond to "dirty" superconductors, and a saturation of the effect on T_c may be expected. (H.D.R.)

9031 A DYNAMO FOR GENERATING A PERSISTENT CURRENT IN A SUPPERCONDUCTING CIRCUIT. J. Volger and P. S. Admiraal (N. V. Phillips' Gloeilampenfabrieken, Eindhoven, Netherlands). Phys. Letters, 2: 257-9 (Oct. 1, 1962). (In English)

Since various integration contours embracing the various holes in a body any integral number of times can be taken, the magnetic flux to be conserved in a multiply connected superconductor is a multi-valued function, the moduli being the magnetic fluxes per hole. The possible consequences of this property for triply connected or more complicated bodies is examined. An example is presented to indicate the topological changes that take place when these bodies are deformed. A device for the generation of current in superconducting coils is sketched and discussed as a superconducting unipolar dynamo. (H.D.R.)

9032 DOUBLE INJECTION WITH NEGATIVE RESISTANCE IN PLASTICALLY DEFORMED GERMANIUM p-n JUNCTIONS. L. J. Van Ruyven and W. H. Th. Adriaens (Universiteit, Eindhoven, Netherlands). Phys. Letters, 3: 109-10(Dec. 15, 1962). (In English)

An explanation based on Lampert's double injection model is proposed for the negative resistance occurring in plastically deformed germanium p-n junctions. The current-voltage characteristics of three samples at various temperatures were measured. The onset of the I-V characteristic at low hole-injection levels is shown to follow the law $I \propto V^2$. At very small injection levels the behavior tends to be more ohmic, and at higher injection levels the steep transition to the negative resistance region takes place. (H.D.R.)

9033 THE ELASTIC ENERGY OF SUPERCONDUCTING FILAMENTS IN IMPERFECT CRYSTALS. R. L. Fleischer (General Electric Research Lab., Schenectady, N. Y.). Phys. Letters, 3: 111-12(Dec. 15, 1962). (In English)

Physical reasons are given why superconducting filaments in hard superconductors should have their lowest free energy when they enclose dislocation lines. Between a dislocation and a superconducting region in a crystal there is an elastic interaction which results from the fact that the elastic moduli and the lattice parameters of crystals are altered when a magnetic field causes a transition from superconducting to normal state. Since a dislocation has an elastic energy proportional to Gb^2, where G is the shear modulus and b is the atomic spacing in the Bravais lattice, the elastic energy will be lowered if a material changes from normal to superconducting and thereby lowers the shear modulus or decreases the lattice parameter. (H.D.R.)

9034 NEGATIVE SURFACE FREE-ENERGY EFFECTS IN SUPERCONDUCTING NIOBIUM. T. F. Stromberg and C. A. Seenson (Ames Lab., Ames, Iowa). Phys. Rev. Letters, 9: 370-4(Nov. 1, 1962). (IS-546)

Reduced magnetization curves at 4.15 and 1.11°K are shown for a polycrystalline wire of niobium prepared to insure very high purity. A plot is given of H_c^2 versus T^2 and is analyzed to give values of the temperature coefficient of the electronic specific heat and H_0. Analysis of the experimental data shows negative surface free-energy effects in a substance where the electronic mean free path is much longer than the superconducting penetration depth.

Also, a much smaller value is implied for the electron velocity at the Fermi surface than the free-electron model would predict. (H.D.R.)

9035 MAGNETIC-FIELD DEPENDENCE OF THE ENERGY GAP IN SUPERCONDUCTORS. V. S. Mathur, N. Panchapakesan, and R. P. Saxena (Univ. of Delhi). Phys. Rev. Letters, 9: 374-5(Nov. 1, 1962).

Investigators have previously worked out formulas for the effect of a magnetic field on the energy gap of a superconductor. For thin films at T ~ 0 the energy gap ϵ varies with magnetic field H according to a formula of the type $\epsilon(H) = \epsilon(0)[1-(H/H_c)^2]$, where H_c is the critical field. It is pointed out that the above formula can be derived from the results of work by Gupta and Mathur (GM) on the energy gap. The GM expressions also are shown to reproduce the experimentally observed small decrease in the energy gap for bulk matter. An explanation is given on the basis of these calculations for the change in the nature of transition at film thickness $d \sim 5^{1/3} \lambda$, where λ is the penetration depth. (H.D.R.)

9036 TEMPERATURE DEPENDENCE OF CRITICAL CURRENT DENSITY IN SUPERCONDUCTING TIN THIN FILMS. J. E. Mercereau and L. T. Crane (Ford Motor Co., Dearborn, Mich.). Phys. Rev. Letters, 9: 381-3 (Nov. 1, 1962).

Measurements of critical current density in thin tin films have been made utilizing an induction method. The results confirm previous critical current measurements near T_c and further reveal a peak in the critical current density near a reduced temperature (T/T_c) of 0.65. This behavior deviates markedly from theoretical predictions except near T_c. At the lowest temperatures the magnitude of the critical current is considerably lower than the asymptotic value expected at T = 0. These results indicate that some process not presently accounted for by theory is the limiting factor in the critical current density in soft superconducting films. (H.D.R.)

9037 COMMENTS ON CORRELATION CALCULATIONS IN ANISOTROPIC DIFFUSION. James G. Mullen (Argonne National Lab., Ill.). Phys. Rev. Letters, 9: 383-5(Nov. 1, 1962). (TID-16916)

A method is proposed for calculating correlations for impurity diffusion. The method can be applied to any lattice, isotropic or anisotropic, and permits all symmetrically inequivalent dissociative jump frequencies to be uniquely specified without adding to the complexity of the calculation. The method is compared with other methods for the face-centered-cubic, body-centered-tetragonal, and hexagonal-close-packed lattices. An accurate empirical representation of previously calculated self-diffusion correlations is given for the bct and hcp lattices. (H.D.R.)

9038 DIRECT MEASUREMENT OF THE ENERGY OF ELECTRONS OBTAINED FROM THE SURFACE OF SILICON BY FIELD EMISSION. Allan M. Russell (Univ. of California, Riverside). Phys. Rev. Letters, 9: 417-18 (Nov. 15, 1962).

In the courses of the development of a field-emission spectrometer designed to measure the energy spectrum of electrons obtained by field emission from the surface of semiconductors, some measurements have been made of the critical bias for a silicon sample at room temperature. The critical bias is shown as a function of applied voltage. The energy of the electrons is below the Fermi energy by an amount less than one-half the band gap for silicon. This is in keeping with the fact that silicon develops a strong p-type surface due to boron contamination when heated in a Pyrex vacuum system. (H.D.R.)

9039 MAGNETIZATION OF V_3Si THIN FILMS. J. J. Hauser (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters, 9: 423-5(Nov. 15, 1962).

The magnetization of V_3Si as a function of sample size was examined over a range from 5×10^{-5} to 0.1 cm and also as a function of temperature. The data presented can be interpreted in terms of both models for the magnetization of hard superconductors. The validity of the filamentary model is shown and, once the size dependence is eliminated by measuring the thinner samples, the underlying curve is that proposed by the negative surface energy model. Both models probably apply in a real material, and it is likely that negative surface energy is what is required to make a defect such as a dislocation behave as a filament. A field penetration depth of approximately 15,000 Å was measured in the thinner films and was found to increase with temperature faster than the usually observed dependence. (H.D.R.)

9040 EVIDENCE FOR THE NEGATIVE SURFACE ENERGY MODELS OF SUPERCONDUCTIVITY IN Nb_3Sn, Nb_3Al, V_3Ga, AND V_3Si. Paul S. Swartz (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. Letters, 9: 448-51(Dec. 1, 1962).

The magnetization loops of powdered Nb_3Sn, Nb_3Al, V_3Ga, and V_3Si do not close symmetrically about the applied magnetic field axis with decreasing particle size, as should be expected if high-field superconductivity originates solely from the presence of physically real superconducting filaments. The asymmetric magnetization loops obtained have a form very similar to that predicted by the negative surface energy models of superconductivity. The results for the four intermetallics in terms of the induced superconducting current density and the magnetic field at which fluxoids first penetrate into the superconductor are presented and discussed. (H.D.R.)

9041 SOME OBSERVATIONS OF GROWING OSCILLATIONS IN AN ELECTRON-HOLE PLASMA. Betsy Ancker-Johnson (Boeing Scientific Research Labs., Seattle). Phys. Rev. Letters, 9: 485-7(Dec. 15, 1962).

Highly reproducible growing oscillations have been observed in electron-hole plasma produced by injection from current contacts into single-crystal p-type indium antimonide at 77°K. Two types of growing oscillations have been observed in different samples. In one type, the frequency is current controlled; in the other, the frequency is independent of current. Both occur in the absence of an applied magnetic field. The observed behavior of these oscillations is presented and discussed. (H.D.R.)

9042 HIGH-FIELD SUPERCONDUCTIVITY IN NIOBIUM. S. H. Autler (Massachusetts Inst. of Tech., Lexington), E. S. Rosenblum, and K. H. Gooen. Phys. Rev. Letters, 9: 489-93(Dec. 15, 1962).

A number of experiments on Nb wires in magnetic fields are described and interpreted. The resistance of current-carrying Nb wires decreases in some regions by orders of magnitude as the applied field is increased by a few hundred gauss with the current, I, and the temperature, T, held constant. When I and H are constant and T is varied, there are regions where the sample goes from a resistive to a superconducting state as the temperature is increased. Measurements of I versus H at constant voltage, across Nb samples that have undergone different heat treatments, indicate different mechanisms governing high-field superconductivity. Sometimes evidences of both are seen in the same sample, and there is strong evidence that one of these mechanisms is of the Abrikoson type. Pure niobium is

probably a superconductor of the second group in the Ginsburg-Landau sense, with $\kappa = 1.3$ at 4.2°K. (H.D.R.)

9043 VELOCITY DEPENDENCE OF THE TOTAL CROSS SECTION FOR ATOM-ATOM SCATTERING AT THERMAL ENERGIES. P. K. Rol and Richard W. Rothe (General Dynamics/Astronautics, San Diego, Calif.). Phys. Rev. Letters, 9: 494-5(Dec. 15, 1962).

Measurements of the velocity (v_r) dependence of the total cross section (Q) for the scattering of Li by the rare gases are described. These measurements show a predicted systematic change in the form of $Q(v_r)$ as the scattering changes from a characteristic undulatory "low-velocity" behavior to a monotonically decreasing v_r dependence in the "high-velocity" region. (H.D.R.)

9044 SPIN EXCHANGE IN ELECTRON-HYDROGEN COLLISIONS. M. H. Mittleman (University Coll., London). Phys. Rev. Letters, 9: 495-6(Dec. 15, 1962).

In rearrangement collision problems with approximations for the exact wave functions, the various forms of expressions for the transition (T) matrix give different results. The low-energy scattering of electrons by hydrogen atoms has recently been solved by elaborate numerical methods in both singlet and triplet states. The three widely different methods all yield similar results. From these results, the spin-exchange amplitude is extracted and two approximate forms of T are tested. The study is confined to incident S-wave electrons. (H.D.R.)

9045 MEAN FREE PATH OF HOT ELECTRONS AND HOLES IN METALS. R. N. Stuart (Univ. of California, Livermore), F. Wooten, and W. E. Spicer. Phys. Rev. Letters, 10: 7-9(Jan. 1, 1963). (UCRL-7141)

The mean free paths and attenuation lengths of hot electrons and holes in metals are calculated by Monte Carlo methods. The results are compared with experimental results for electrons in Au, Ag, Cu, and Pd and holes in Au. (T.F.H.)

9046 OPTICAL DETECTION OF LEVEL CROSSING A $J = \frac{1}{2}$ STATE. Alan Gallagher and Allen Lurio (Columbia Univ., New York). Phys. Rev. Letters, 10: 25-6(Jan. 1, 1963).

It is shown theoretically that a level-crossing signal from the $m_J = \pm\frac{1}{2}$ sublevels of a $J = \frac{1}{2}$ state populated by optical excitation from a $J = \frac{1}{2}$ or $\frac{3}{2}$ ground state can be observed by observing the scattering of circularly polarized light from the substance. Both the incident-light and scattered-light directions are assumed perpendicular to the applied d-c magnetic field. The effect is measured in Tl, and the lifetime of the $S_{\frac{1}{2}}$ level of Tl is calculated to be $(7.6 \pm 0.2) \times 10^{-9}$ sec by analysis of the width of this level. (T.F.H.)

9047 ON DISTRIBUTIONS AND SPACES OF SEQUENCES. I. GENERAL THEORY. Tadashige Ishihara and Hideo Yamagata (Osaka Univ.). Proc. Japan Acad., 38: 327-32(1962). (In English)

The notion of distribution is extended to the spaces of sequences, and the generalized distribution is introduced. Various operations in these spaces are discussed, including multiplication. The construction of a formalism for handling some types of improper singular functions (e.g., the Dirac δ function) is discussed. (T.F.H.)

9048 ON DISTRIBUTIONS AND SPACES OF SEQUENCES. II. ON THE MULTIPLICATIONS OF IMPROPER FUNCTIONS IN QUANTUM FIELD THEORY. Tadashige Ishihara and Hideo Yamagata (Osaka Univ.). Proc. Japan Acad., 38: 333-8(1962). (In English)

Examples of multiplications of improper singular functions (e.g., $\delta \cdot \delta$, where δ is the Dirac δ function) are described, for functions that are important in quantum field theory. The multiplications are carried out in the spaces of sequences. (T.F.H.)

9049 ON UNIFIED REPRESENTATION OF STATE VECTOR IN QUANTUM FIELD THEORY. Hideo Yamagata and Tadashige Ishihara (Osaka Univ.). Proc. Japan Acad., 38: 339-44(1962). (In English)

Hilbert spaces having non-countable bases that correspond to a sequence of non-negative integers are considered. These bases can be identified with the points on the interval ([0,1]) from 0 to 1 by means of a one-to-one mapping. For a point γ in [0,1], a Lebesgue measure $\underline{dm}(\gamma)$ is taken, and the element of the Hilbert space corresponding to γ is found as an integral function with respect to $dm(\gamma)$. This integral function is a unified single integral that uses generalized distributions. (T.F.H.)

9050 ON COLLISIONS BETWEEN TWO NORMAL HELIUM ATOMS. Tasuke Hashino (Kurume Technical Coll., [Japan]). Progr. Theoret. Phys. (Kyoto), 28: 624-30(Oct. 1962). (In English)

Born's approximation is used to calculate the cross sections for the processes $He(1s^2) + He(1s^2) \rightarrow He(1s^2) + He(1s^2, 1s2p, \text{or } 1s2s)$, and no account is taken of exchange. It is found that the elastic cross section is very much larger at all impact energies than the inelastic cross sections. (auth)

9051 ON THE GREEN'S FUNCTIONS OF THE HEISENBERG SPIN SYSTEMS. Kyozi Kawasaki and Hazime Mori (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 28: 690-710(Oct. 1962). (In English)

The static spin pair correlation and the susceptibilities of ferromagnetics with spin $\frac{1}{2}$ are studied by the method of the two-time Green's function, adopting the Heisenberg model. A marked difference is found in the behavior of these quantities for systems with anisotropic and isotropic exchange interactions. In particular, for the case of the isotropic exchange interaction, the parallel susceptibility diverges below the Curie point down to the spin wave region. Consequently, the susceptibility immediately above the Curie temperature deviates from the Curie-Weiss law. (auth)

9052 A NOTE ON THE EVOLUTIONARY CONDITION ON HYDROMAGNETIC SHOCKS. Tosiya Taniuti (Kobe Univ., Japan). Progr. Theoret. Phys. (Kyoto), 28: 756-7 (Oct. 1962). (In English)

It is proved that for hydromagnetic fast and slow shocks the evolutionary condition implies the entropy condition, i.e., that the evolutionary condition and the conservation laws determine a physically relevant solution. This proof is carried out by considering an evolutionary magneto-acoustic (fast or slow) shock. (T.F.H.)

9053 SPIRAL SPIN POLARIZATION OF BAND ELECTRONS. Kei Yosida (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 28: 759-60(Oct. 1962). (In English)

The possibility of obtaining a spiral spin polarization of conduction-band electrons in metals is inferred, by taking into account Umklapp processes or interband effects. The existence of such a structure in bcc Cr is discussed. (T.F.H.)

9054 PHASE FLUOROMETER TO MEASURE RADIATIVE LIFETIMES OF 10^{-6} TO 10^{-9} Sec. Leo Brewer, C. Geoffrey James, Richard G. Brewer, Fred E. Stafford, Robert A. Berg, and Gerd M. Rosenblatt (Univ. of California, Berkeley). Rev. Sci. Instr., 33: 1450-5(Dec. 1962).

Apparatus to measure radiative lifetimes by the phase-

shift method is described. A rotating-wheel, reflection grating modulates light at 60 kc for the measurement of lifetimes of 10^{-5} to 10^{-7} sec. An ultrasonic grating is used for modulation at 5.2 Mc to study lifetimes of 10^{-7} to 10^{-9} sec. Optical and electronic sources of systematic error have been investigated. Procedures were developed to minimize systematic errors in the lifetime measurements. Measurements on solid $BaPt(CN)_4 \cdot 4H_2O$ are reported. Iodine vapor and solutions of organic molecules also were studied. (auth)

9055 RESPONSE OF CsI(Tl) AND NaI(Tl) TO LOW-ENERGY CHARGED PARTICLES. Richard W. Hill (Univ. of California, Livermore). Rev. Sci. Instr., 33: 1477-8 (Dec. 1962). (UCRL-6986)

A calibration study was carried out on CsI(Tl) and NaI(Tl) crystals at very low energies (0 to 60 kev). The responses are plotted on pulse height vs energy graphs for the ions H^+, H_2^+, He^+, and He^{2+} and also for W^{181} x rays. The response curves show a trend toward decreasing pulse height with increasing particle mass and ionizing power, with the trend being smaller for CsI(Tl) than for NaI(Tl). (D.L.C.)

9056 PULSE NEUTRON GENERATOR. Takeshi Adachi (Central Research Lab., Tokyo), Kazuyuki Ogawa, and Katsuhiko Miyoshi. Toshiba Rev., Intern. Ed., No. 11, 12-20(1962). (In English)

Deuterium is ionized into deuterons in a radio-frequency ion source; then these deuterons, being accelerated at 100 to 200 kv in an accelerator tube, are made to bombard the tritium target for nuclear fusion, thereby producing neutrons. (R.J.S.)

9057 ELECTRON OPTICS OF SURFACE BEAMS. Yu. P. Pyt'ev. Vestn. Mosk. Univ., Ser. III, No. 4, 3-13 (July-Aug. 1962). (In Russian)

An analysis was made of charged particle trajectories in the proximity of an arbitrary electromagnetic surface. The derived equations for trajectories close to the surface were used in surface particle beam focusing problems. (R.V.J.)

9058 ON THE STABILITY OF FRACTIONS-LIKE SOLUTIONS OF NON-LINEAR SCALAR FIELD EQUATIONS. Yu. P. Rybakov. Vestn. Mosk. Univ., Ser. III, No. 4, 24-9 (July-Aug. 1962). (In Russian)

A normalized A. M. Lyapunov stability theorem for distributed systems (with an infinite degree of freedom) was used in developing a general method for determining the stability of non-linear field equations. The stability of fraction-like solutions of nonlinear scalar field equations was analyzed. (tr-auth)

9059 CYLINDRICAL WAVES OF FINITE AMPLITUDE IN DISSIPATIVE MEDIUM. K. A. Naugol'nykh, S. I. Soluyan, and R. V. Khokhlov. Vestn. Mosk. Univ., Ser. III, No. 4, 65-71(July-Aug. 1962). (In Russian)

Propagation of diverging and converging cylindrical waves in a nonlinear, viscous, heat conducting medium is analyzed using approximation methods. The Krylov-Bogolyubov method was used for small Raynold's numbers, and the method of S. I. Soluyan et al. (Vest. Mosk. Univ. ser. phys. and astronomy 3, 52-61, 1961), was used for large Raynold's numbers. The formation and dissipation of shock fronts and spatial dimensions of shock phenomena were analyzed. It is shown that the problem of finite-amplitude cylindrical wave propagation is identical to the problem of plane wave propagations in a medium with variable viscosity. (tr-auth)

9060 TRANSIENT BEHAVIOR OF THE BROADENING OF SPECTRAL LINES AND OF THE ION CONCENTRATION IN SPARK DISCHARGES. Árbád Bardócz, Tibor Voeroes, and Urhegyi Marta Vanyek (Hungarian Academy of Sciences, Budapest). Z. Angew. Phys., 14: 581-4(Sept. 1962). (In German)

The transient behavior of the ion concentration in the spark discharge of Mg, Zn, Cd, and Hg was determined. The determination of the ion concentration was made on the basis of the spectral line broadening arising as a result of the Stark effect. Since the Lorentz-Weisskopf impact theory establishes a relation between the broadening arising from the Stark effect and the ion number/cm^3, the determination of the ion concentration in dependence on time was possible. With the help of this theory, the correction of the measured half-value width of the spectral lines was carried out with the measurement of the wave length displacement of the spectral lines. The measurements were made on time resolved spectra so that the separation of the line broadening and of the wave length displacement was possible. The time-resolved spectra were prepared with an electronic-operated spark generator of high precision and with rotating optics. The time resolution is of the order of one microsecond. (tr-auth)

9061 THE ELECTRON MOTION IN THE NEUTRAL GAS IN HIGH ELECTRICAL FIELDS. Karl Gerhard Mueller (Universität, Bonn). Z. Physik, 169: 432-55 (1962). (In German)

In strong electric fields the acceleration of electrons by the field exceeds the deceleration by collisions with neutral molecules. Thus run-away or beam electrons are produced. The motion of the beam electrons in a neutral gas considering ionization processes by electron-molecule impacts is investigated. Starting with a time independent current of primary electrons (case a) and a space independent density of primary electrons (case b), the development of the velocity distribution is calculated. For a molecular hydrogen gas the amplification of the initial electrons, the average ionization, and the velocity distribution of the electrons as a function of space or time respectively are given. The average ionization has an asymptotic solution, which becomes valid, when one primary electron has produced by ionization an avalanche of approximately 100 electrons. The Townsend coefficient α for high values of the field strength is independent of space only in the region of this asymptotic solution. (auth)

9062 MAGNITUDE OF QUADRUPOLE INTERACTION BETWEEN Sn^{119m} NUCLEI AND CRYSTAL LATTICE. G. M. Gorodinskii, L. M. Krizhanskii, and E. M. Kruglov. Zh. Eksperim. i Teor. Fiz., 43: 2050-2(Dec. 1962). (In Russian)

The magnitude of the quadrupole interaction between the Sn^{119m} nucleus and lattice of β-Sn and other tin compounds is measured. It is shown that the discrepancy of previously published experimental results may be due to instrumental splitting of the measured line. The cause of this instrumental splitting is indicated. (auth)

9063 EFFECT OF γ-RADIATION ON THE SHAPE OF MÖSSBAUER RESONANCE ABSORPTION SPECTRA IN TIN-ORGANIC COMPOUNDS. A. Yu. Aleksandrov, N. N. Delyagin, K. P. Mitrofanov, L. S. Polak, and V. S. Shpinel (Moscow State Univ. and Inst. of Chemical Synthesis of Petroleum, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2074-6(Dec. 1962). (In Russian)

The effect of γ radiation on the shape of the spectra of Mössbauer resonance absorption of 23.8-kev γ quanta in tin-organic compounds is investigated. The change in the spectrum for the compound $(C_4H_9)_2\ SnSO_4$ corresponds to splitting of the compound and formation of the compounds $SnSO_4$ and possibly $(C_4H_9)_2\ SnSO_3$ (upon irradiation in vac-

uum). Irradiation of the indicated compound in the presence of oxygen leads to its oxidation to SnO_2 (or some other compound with a similar electron configuration in the tin atom). When the polymer $[(C_4H_9)_2Sn(OCOCCH_2CH_2)_2]_n$ was irradiated, the quadrupole splitting doublet lines were found to broaden and a concurrent relative decrease of the height of one of the components took place. (auth)

9064 INVESTIGATION OF THE PHONON SPECTRUM OF VANADIUM. N. A. Chernoplekov, M. G. Zemlyanov, and A. G. Chicherin. Zh. Eksperim. i Teor. Fiz., 43: 2080-5(Dec. 1962). (In Russian)

The spectrum of neutrons inelastically scattered on a vanadium sample is measured with a time-of-flight neutron spectrometer. The vanadium phonon spectrum is reconstructed on the basis of the experimental data by employing an electronic computer and the accuracy of the reconstruction is determined. (auth)

9065 CALCULATION OF THE 2p → 1s TRANSITION ENERGY IN μ-MESIC ATOMS. G. E. Pustovalov (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2170-2 (Dec. 1962). (In Russian)

The 2p → 1s transition energy in μ-mesic atoms is calculated for $13 \leq Z \leq 57$ and various models of charge distribution in the nucleus. When a Fermi type model is employed in conjunction with the parameters found by Hofstadter et al. from electron scattering on nuclei, the calculations are found to be in satisfactory agreement with the experimental data on the radiation from mesic atoms with the indicated values of Z. (auth)

9066 ON THE OBSERVED PROBABILITIES FOR ELASTIC SCATTERING OF NEUTRONS AND THE MÖSSBAUER EFFECT IN DEGENERATE SYSTEMS AND ON SOME NEW POSSIBILITIES OF CREATING SUCH SYSTEMS. M. V. Kazarnovskii and A. V. Stepanov (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 2299-2301(Dec. 1962). (In Russian)

It is shown that the usual definition of elastic scattering of slow neutrons and of the probability of the Mössbauer effect in degenerate systems is incorrect. Some qualitative phenomena which can be observed in such systems are discussed. Some new systems in which the Mössbauer effect may be observed are considered. (auth)

9067 DETERMINATION OF JOULE DISSIPATION IN MAGNETO-HYDRODYNAMIC GENERATOR CHANNEL. A. B. Vatazhin. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 59-69(Sept.-Oct. 1962). (In Russian)

Studies were made of Joule dissipation in a gas flowing with alternating electric conductivity in a channel with insulated walls. The Joule dissipation, generator efficiency, and approximate electric conductivity variations were found on the basis of data developed for a magnetic field with constant conductance in a finite electron channel. The distribution of electric magnitudes in a channel with a cosine velocity profile was also determined. (R.V.J.)

9068 EVOLUTIONARY MAGNETOHYDRODYNAMIC FLOW. K. P. Cherkasova (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 144-5(Sept.-Oct. 1962). (In Russian)

A quasi-one-dimensional stationary flow in a channel was studied in order to determine the effects of evolution (a motion along the Mack number M_+ or M_- passing through $M_+ = 1$ or $M_- = 1$, respectively, $M < 1$ or $M > 1$) on various continuous magnetohydrodynamic flows in variable cross section channels. It was shown that the flow through $M_+ = 1$ is evolutionary at a minimum channel cross section. (R.V.J.)

9069 INTERCOMPARISONS OF THE STANDARD THERMAL NEUTRON FLUX DENSITY OF THE NATIONAL BUREAU OF STANDARDS. W. M. Murphey and J. Chin (National Bureau of Standards, Washington, D. C.). IAEA Preprint SM-36/78. 14p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

The standard thermal neutron flux maintained at the National Bureau of Standards in Washington since 1951 consists of two radium-beryllium (α,n) sources in a thermalizing geometry of lead and paraffin. The flux has been absolutely measured twice; once in terms of the absorption cross section of boron, and once in terms of the absorption cross section of gold. A neutron flux with a cadmium ratio of 7 (for 40 mg/cm^2 gold foils and 0.040 inch cadmium covers) and a thermal neutron flux density of $4231 \pm 1.5\%$ (Apr. 62) neutrons per cm^2-sec is obtained. A slot in an eight inch thick carbon region perpendicular to the line joining the two sources and midway between them affords access to the flux. Over an area 7×6 cm in size in the center of the slot the thermal neutron flux density has been measured to be spatially constant to within 0.5%. The effect of any anisotropy of the flux on the measurement of the thermal neutron flux density by gold foils has been determined to be less than 0.04%. (auth)

9070 AEROSOLS FROM EXPLODING WIRES. F. G. Karioris (Marquette Univ., Milwaukee), B. R. Fish, and G. W. Royster, Jr. p.299-311 of "Exploding Wires. Vol. 2." New York, Plenum Press, Inc., 1962.

A large fraction of an exploded wire can be recovered reproducibly from the solid aerosol disperse phase produced by explosions at various voltages (1 to 18 kv) on a 20-μf capacitor bank. Typical smokes consisting of oxide particles are produced by explosions of base metals in air and fine metallic particles are produced by the explosion of Ag, Au, and Pt in air or by Al and Cu exploded in argon. Primary particle size and size distribution are related to the voltage used for explosion. Aerosol yield curves for copper and uranium are discussed in the light of previously described exploding wire phenomena. The method is well suited for the production of small quantities of solid aerosols. (auth)

9071 SUPERCONDUCTING MAGNETS FOR MAGNETOPLASMADYNAMIC POWER GENERATION. G. W. Wilson and D. C. Roberts (C. A. Parsons and Co. Ltd., Newcastle upon Tyne, Eng.). Preprint Paper 42, Session I. Prepublication Copy. 10p.

Relevant properties of superconducting materials and the geometry of the magnetic coils are described. A preliminary design of the low-temperature plant is presented. The advantages of a superconducting magnet system over a conventional one are a reduction in magnet volume and weight and an increase in the efficiency of the generator due to the elimination of Joule heating in the magnet. The cost of a superconducting magnet system is estimated to be approximately the same as the cost of a conventional magnet, but the operating cost should be considerably lower. (M.P.G.)

9072 AN OPEN-CYCLE MPD GENERATOR OPTIMIZATION STUDY. F. J. P. Crampton and T. S. Wilkinson (C. A. Parsons and Co. Ltd., Newcastle upon Tyne, Eng.). Preprint Paper 40, Session I. Prepublication Copy. 17p.

The one-dimensional magnetoplasmadynamic (MPD) flow equations are solved for a system using seeded combustion gases. The net specific power output of an open-

cycle MPD generator can be maximized by appropriate selection of the load factor, flow velocity, and magnet shape. Magnet design data are presented for accurate calculation of the field strength at the center of a rectangular coil. (M.P.G.)

9073 CERAMIC MATERIALS FOR M.P.D. POWER GENERATION. M. A. Hepworth (Thermal Syndicate Ltd., Wallsend, Eng.) and G. Arthur. Preprint Paper 39, Session I, Prepublication Copy. 12p.

Various oxides were heated in Ta and W crucibles at temperatures up to 2,200°C, and the weight losses were measured From these results and published data, it was concluded that W electrodes and HfO_2 or ThO_2 insulators could be used in a closed-cycle magnetoplasmadynamic generator. For an open-cycle generator, electrodes of "doped" ZrO_2 and insulators of $SrO \cdot ZrO_2$, HfO_2, or ThO_2 would be possible. (M.P.G.)

9074 WALL EFFECTS IN AN MHD GENERATOR. D. T. Swift-Hook (Central Electricity Research Labs., Leatherhead, Surrey, Eng.). Preprint Paper 37, Session I. Prepublication Copy. 19p.

The effects of friction and heat transfer in magnetohydrodynamic ducts were calculated from existing formulas. The wall effects were found to be predominant in small-scale models and likely to be important in large-scale MHD generators. More experimental work is required before accurate values can be obtained. (M.P.G.)

9075 SOME ECONOMIC AND DESIGN CONSIDERATIONS OF LARGE-SCALE MPD GENERATORS. B. C. Lindley (C. A. Parsons and Co. Ltd., Newcastle upon Tyne, Eng.). Preprint Paper 34, Session I. Prepublication Copy. 9p.

The economic advantages of using magnetoplasmadynamic (MPD) generators in conjunction with steam plants for large-scale electrical power generation are analyzed. It is estimated that, if the capital cost of the combined MPD plant is the same as the conventional steam plant, the cost of electricity produced may be reduced by about 12% for a fossil fuel-MPD-steam plant and by about 8% for a nuclear-MPD-steam plant. The problems associated with the construction of generator ducts are discussed, and a modular principle for duct construction is suggested. The minimum electrical power outputs for feasible and self-sustaining MPD generators are estimated from calculations based on the duct geometry. (M.P.G.)

9076 HIGH MAGNETIC FIELDS AND MAGNETO-AERODYNAMIC GENERATORS. G. Klein (Compagnie Générale d'Electricité Marcoussis, Seine-et-Oise, France). Preprint Paper 30, Session I. Prepublication Copy. 15p.

The necessity for high magnetic fields to generate electricity by magnetoaerodynamics is demonstrated. The production of high magnetic fields by air-cored and iron-cored magnets with water-cooled or liquid-nitrogen-cooled coils is studied as a function of the total investment necessary to produce the magnetic field. The results are quite different for experimental generators (short runs) and central power generators running 6000 hours a year. The use of superconducting magnet coils is also considered. It is concluded that liquid-nitrogen-cooled coils allow a substantial gain in consumed power and investment price compared to water-cooled coils. (M.P.G.)

9077 THEORETICAL INVESTIGATIONS OF AN A.C. MHD POWER GENERATOR. Jerome B. Fanucci (Radio Corp. of America, Moorestown, N. J.). Preprint Paper 29, Session I. Prepublication Copy. 14p.

The electric impedance of an a-c generator is calculated for infinite-length generators and semi-infinite generators using a small perturbation expansion. The power factor and the power extracted from the generator are then determined. It is concluded that the plasma conductivity must be large if a-c magnetohydrodynamic power generation is to be economically feasible. For low-frequency operation, fringing losses must be kept to a minimum. High magnetic fields are necessary to obtain reasonable power densities at low plasma velocities. (M.P.G.)

9078 SOME FACTORS INFLUENCING THE DESIGN OF OPEN CYCLE FOSSIL FUEL MHD GENERATORS FOR THE ELECTRICITY SUPPLY INDUSTRY. J. K. Wright, R. V. Harrowell, D. C. Gore, and C. V. Barnett (Central Electricity Research Lab., Surrey, Eng.). Preprint Paper 27, Session I. Prepublication Copy. 5p.

The results of a preliminary study of factors influencing the design of magnetohydrodynamic generators are presented. The effects of choice of fuel and seed material, amount of preheating and compression, production of the magnetic field and design of the generator duct are discussed. A decrease in power-generation costs can be expected from a MHD plant. More study is required to determine whether a MHD plant is feasible for central power stations. (M.P.G.)

9079 OPERATING CHARACTERISTICS OF THE MHD INDUCTION GENERATOR. W. D. Jackson and E. S. Pierson (Massachusetts Inst. of Tech., Cambridge). Preprint Paper 26, Session I. Prepublication Copy. 15p.

Calculations are performed to show that the electrical characteristics of a magnetohydrodynamic induction generator depend upon the product of the slip, s, and the magnetic Reynolds number, R_M. The efficiency depends only upon s, which must be kept small for efficient operation. Maximum power output occurs at $sR_M = -1$. Currently available ionized gas flows do not have a sufficiently high conductivity to obtain an acceptable value of R_M. Liquid metal flows give reasonable values of R_M, and generators using liquid metals appear to be feasible. (M.P.G.)

9080 GENERAL THEORY OF CHOKING PERFORMANCE IN A MAGNETOHYDRODYNAMIC CONVERTER. A. Lemaire and P. Zettwoog (Commissariat a l'Energie Atomique, Saclay, France and l'Institut Francais du Petrole, Rueil-Malmaison, France). Preprint Paper 23, Session I. Prepublication Copy. 8p.

From one-dimensional equations of steady-state motion, the incremental changes in velocity, pressure, specific mass, temperature, and channel cross section are calculated for incremental changes in position along the direction of flow in a conventional MHD channel. The results are applied to specific cases, and under certain conditions it is shown that a continuous flow is not possible. This choking effect can be avoided by a suitable choice of the load factor. (M.P.G.)

9081 DISCUSSION OF A SELF-POWERED MHD CONTROL FOR RE-ENTRY VEHICLE APPLICATION. C. duP. Donaldson (Aeronautical Research Associates of Princeton, N. J.) and M. J. Brunner. Preprint Paper 22, Session I. Prepublication Copy. 19p.

It is suggested that the flight path of a re-entry vehicle could be controlled by electric and pressure forces acting on a magnetohydrodynamic channel. The magnetic field could be maintained by an electromagnet powered by the plasma in the channel. Four MHD channels could be located about the space vehicle to control both pitch and yaw. The performance of a MHD control is estimated by solution of the MHD flow equations. The requirements af-

fecting the design of the channel are discussed. Initial studies indicate that a MHD control system is feasible. (M.P.G.)

9082 SOME CONSIDERATIONS INFLUENCING THE USE OF AN OPEN CYCLE MPD DEVICE FOR THE GENERATION OF BASE LOAD ELECTRIC POWER. J. F. Barnes (National Gas Turbine Establishment, Pyestock, Farnborough, Eng.). Preprint Paper 6, Session I. Prepublication Copy. 8p.

A thermodynamic study of an open-cycle magnetoplasmadynamic (MPD) generator system is presented. A comparison was made between the thermal efficiencies expected from an open-cycle MPD system and a combined gas and steam turbine plant. Graphs of thermal efficiency as a function of gas temperature are presented for both types of plants. (M.P.G.)

9083 THE MHD GENERATION OF D.C. POWER. D. M. Gilbey (Royal Aircraft Establishment, Farnborough, Eng.). Preprint Paper 13, Session I. Prepublication Copy. 24p.

The problems involved in the design of power stations using a magnetohydrodynamic generator are discussed in detail. A thermodynamic analysis is performed on one scheme for a MHD generator topping a steam cycle, and data are presented. Depending upon the gas pressure of the cycle and duct gas entropy, the cycle efficiency, for the system studied, was found to be between 48% and 58%, where the steam cycle without the MHD generator would have an efficiency of 40.4% using the same assumptions. The performance of an MHD generator is studied using the equations for flow of gas in a duct. The effects of gas conductivity and ion slip are discussed, and the heat-transfer loss is calculated. Magnet design and materials for the duct and electrodes are also discussed, and the major areas for further study are listed. (M.P.G.)

9084 AN INVESTIGATION OF MHD GENERATORS BY A SIMPLIFIED GRAPHICAL METHOD. B. Buergel (Brown, Boveri and Co., Ltd., Baden, Switzerland). Preprint Paper 17, Session I. Prepublication Copy. 8p.

To simplify the analysis of magnetohydrodynamic generator, it is assumed that all electrical quantities and the gas velocity are constant in space and time within the active part of the generator. The electrical power output, the braking power, and the turbine efficiency are calculated using a graphical method. The analysis of special types of MHD generators is facilitated by the use of the graphs. (M.P.G.)

9085 MHD GENERATOR WITH SERIES-CONNECTED ELECTRODES. A. de Montardy (Electricite de France, Paris). Preprint Paper 19, Session I. Prepublication Copy. 8p.

A magnetohydrodynamic "series generator" or "constant field direction generator" is described in which power is extracted through segmented series-connected electrodes to a single load. The characteristics of this type of MHD generator are analyzed and compared to those of a similar generator in which the power is extracted through segmented electrodes into separate loads. It is concluded that the "series generator" delivers the same power density under load with less complexity than the generator with separate loads and is better suited for working at low values of the load factor. (M.P.G.)

9086 ON HYDROMAGNETIC FLOW. E. Levi and M. Sandler (Polytechnic Inst., Brooklyn). Preprint Paper 3, Session IV. Prepublication Copy. 7p.

The hydromagnetic equations are solved for the steady-state, one dimensional flow of an inviscid fluid across a magnetic field. It is shown that the flow velocity, v, when plotted as a function of the spatial variable, x, possesses a turning point. No physically realizable flow can exist which satisfies the hydromagnetic equations for values of x beyond the turning point For isothermal flow, the velocity at the turning point is of the order of the thermal velocity, but for adiabatic flow, the turning-point velocity is much smaller than the thermal velocity. (M.P.G.)

9087 HALL EFFECT AND END LOOP LOSSES OF MAGNETOHYDRODYNAMIC GENERATORS. L. S. Dzung (Brown, Boveri and Co. Ltd., Baden, Switzerland). Preprint Paper 2, Session IV. Prepublication Copy. 12p.

Eddy-current or end-loop losses in a magnetohydrodynamic generator are studied, taking the Hall effect into consideration. Equations are derived for a steady two-dimensional electric field in a plane perpendicular to the applied magnetic field of a constant-area duct, assuming that the magnetic Reynolds number is small. By use of the derived equations, the region around the electrode ends of the MHD generator channel is investigated. The end losses are found to increase very rapidly with β, the ratio of the Hall voltage to the ohmic voltage, if continuous electrodes are used. Electrode segmentation increases the power density and reduces the relative end losses. Graphs of current paths and potential lines are presented for continuous electrodes with and without Hall effects. (M.P.G.)

9088 A NOTE ON THE BOUNDARY CONDITIONS IN MAGNETOHYDRODYNAMIC CHANNEL FLOW. F. J. Young and W. F. Hughes (Carnegie Inst. of Tech., Pittsburgh). Preprint Paper 1, Session IV. Prepublication Copy. 5p.

The general boundary conditions for flow in a channel or adjacent to a wall are derived. The magnetic boundary condition for ordinary channel flow, with the applied magnetic field normal to the plate, is found to depend upon the plate thickness, the ratio of plate to fluid conductivity, and especially upon the external circuit connected to the electrodes. (M.P.G.)

9089 A CLOSED-CYCLE MPD EXPERIMENT. B. C. Lindley (C. A. Parsons and Co. Ltd., Newcastle upon Tyne, Eng.). Preprint Paper 38, Session III. Prepublication Copy. 15p.

Diagrams and pictures of a closed-cycle magnetoplasmadynamic power generator and its components are presented. Constructional features and commissioning tests are described. The generator duct, transfer duct, and expansion nozzle were made from tantalum because of its high melting point, ease of fabrication, and resistance to attack by alkali metals in the liquid and vapor phases. (M.P.G.)

9090 NON-EQUILIBRIUM R.F. PLASMAS FOR MAGNETOGASDYNAMIC ENERGY CONVERSION. M. C. Gourdine (Curtiss-Wright Corp., Wood-Ridge, N. J.). Preprint Paper 35, Session III. Prepublication Copy. 19p.

A nonequilibrium plasma is defined as a gaseous mixture of electrons, ions, and neutrals, each having a different temperature. It is useful in magnetogasdynamic energy conversion, since the desired electrical conductivity can be obtained at a lower mean temperature than with an equilibrium plasma. The production of highly nonequilibrium plasmas using the r-f electric field of an electrodeless discharge is described, and a theoretical analysis is presented. It was found to be difficult to use r-f excited plasma for MGD energy conversion because of the low density of the plasma, high diffusion and recombination losses, and reduction of effective conductivity by the

Hall effect. Experiments to take advantage of the Hall and Klein effects are described, and graphs of the results are presented. The advantages of using r-f excited plasma for MGD energy conversion indicate that further research should be performed. (M.P.G.)

9091 A CLOSED LOOP MHD DEVICE WITH CESIUM SEEDED HELIUM. W. S. Emmerich, G. L. Griffith, R. L. Hundstad, T. C. Tsu, and S. Way (Westinghouse Electric Corp., Pittsburgh). Preprint Paper 33, Session III. Prepublication Copy. 17p.

The design and construction of a closed-loop magnetohydrodynamic device, consisting of motor and generator sections connected to end plenum passages, are described. Helium seeded with Cs will circulate in the loop, and power may be extracted from the generator section while the gas is circulating. A theoretical analysis of the loop operation is presented. When completed, the device will be used to study MHD duct processes, plasma characteristics and properties, and materials and structures for MHD systems (M.P.G.)

9092 MHD WALL AND ELECTRODE EXPERIMENTS. W. F. S. Bugden, J. Maycock, P. G. Meier, and J. A. Noe (Central Electricity Research Lab., C.E.G.B. Leatherhead, Surrey, Eng.). Preprint Paper 31, Session III. Prepublication Copy. 8p.

The design and construction of a small magnetohydrodynamic system, with a thermal input power of 2 Mw, to study wall and electrode performance are described. Preliminary experiments are discussed. The use of alumina cement as electrical insulation between water-cooled surfaces was found to be very successful. (M.P.G.)

9093 RESEARCH ON METHODS OF INCREASING THE ELECTRICAL CONDUCTIVITY IN MHD GENERATORS AT THE SPACE SCIENCES LABORATORY OF GENERAL ELECTRIC COMPANY. George W. Sutton and Authur Sherman (General Electric Co. Space Sciences Lab., Valley Forge, Penna.). Preprint Paper 12, Session II. Prepublication Copy. 8p.

The electric conductivity of monatomic gases in closed cycles can be increased by extra thermal ionization. A method using segmented electrodes to develop the Hall electric field is analyzed Research being conducted to utilize this method is outlined. For other than monatomic gases, the gas temperature must be increased to increase the conductivity. A magnetohydrodynamic generator system using ultrahigh-temperature gases from an oxy-cyanogen flame seeded with Cs is discussed, and the results of calculations are presented. Both methods for increasing conductivity appear to be feasible. (M.P.G.)

9094 EFFECTS OF VISCOSITY IN MAGNETOPLASMADYNAMIC GENERATORS. J. C. Wu (European Atomic Community–CCR, Ispra, Italy and Douglas Aircraft Co., Inc. [Santa Monica, Calif.]). Preprint Paper 16, Session IV. Prepublication Copy. 8p.

A theoretical analysis is presented of some of the effects of nonzero viscosity of the plasma in a cross-field d-c generator. In studying the viscous effects associated with the insulators, it was found that the viscous dissipation is a less serious loss than the reversed current loss. Therefore, the boundary-layer thickness in the generator channel must be minimized in spite of the resulting high viscous dissipation. From the study of flow through a channel, it was found that the effect of viscosity could be minimized by the use of operating temperatures higher than 2500°K, pressures lower than 1 atm., better seeding materials, and nonequilibrium effects. To reduce viscous effects, a heavier plasma could be used, since this would result in a thinner boundary layer. However, for some channel configurations, a lighter plasma will reduce the turbulence. It was found that the reduction in power due to viscous effects associated with the electrodes is much smaller than that due to the insulators. The principal viscous effect of the electrodes is to produce a nonuniform electric field in the channel. (M.P.G.)

9095 ON THE ELEVATION OF ELECTRON TEMPERATURE IN MHD GENERATORS AND ITS EFFECT ON THE GAS CONDUCTIVITY. E. F. Brocher (Battelle Memorial Inst., Geneva). Preprint Paper 8, Session IV. Prepublication Copy. 11p.

The elevation of the electron temperature is given as a function of a parameter, α, which depends on the nature of the gas, the total temperature and gas pressure, and the strength of the magnetic field. An expression for electric conductivity is also derived. Graphs of the elevation of electron temperature as a function of α and electric conductivity, with and without elevated electron temperatures, as a function of α are presented. Electron temperature and electric conductivity in constant-velocity magnetohydrodynamic generators are studied, and the results are shown in graphs. It is concluded that much higher conductivities, electric currents, and power densities can be achieved if the upstream value of α is sufficiently large. Since α is proportional to the square of the magnetic field, the use of high magnetic fields in MHD generators is indicated. It was found that the downstream value of the electron temperature may be higher than at the entrance of the generator under certain conditions, and the electric conductivity shows an increase along the length. (M.P.G.)

9096 CURRENT OUTPUT AND EFFICIENCY OF MHD GENERATORS WITH SEGMENTED ELECTRODES AND NON-UNIFORM VELOCITY PROFILES. Hsuan Yeh (Univ. of Pennsylvania, Philadelphia) and G. W. Sutton. Preprint Paper 11, Session IV. Prepublication Copy. 7p.

The two-dimensional problem of an infinitely long magnetohydrodynamic generator with segmented electrodes of finite length was solved for nonuniform velocity across the channel, including the Hall effect. It was found that nonuniform current distribution does not affect the velocity profile and that the generator efficiency, excluding friction, is exactly equal to the generator loading factor even for nonuniform velocity. The current output is calculated for various electrode geometries and products of cyclotron frequency, ω, and electron collision time, τ. An exact solution is possible when the Hall effect is zero, and the results agree very closely with values calculated from the theory for ratios of electrode spacing to channel width up to 2. (M.P.G.)

9097 ELECTRON—ION RECOMBINATION IN MPD GENERATORS. I. R. McNab and C. A. Robinson (C. A. Parsons and Co. Ltd., Newcastle upon Tyne, Eng.). Preprint Paper 20, Session IV. Prepublication Copy. 11p.

Recombination processes are studied for magnetoplasmadynamic generators employing nonthermal ionization techniques. Experimental recombination coefficients are presented in tabular form. The mechanisms by which electron-ion recombination can take place are radiative recombination, dielectronic recombination, dissociative recombination, and three-body recombination, and each mechanism is analyzed. The application to MPD generators is discussed. (M.P.G.)

9098 ELECTRON HEATING IN HALL-FIELDS OF MAGNETOPLASMADYNAMIC GENERATORS. H. New (EURATOM Research Centre, Ispra, Italy). Preprint Paper 25, Session IV. Prepublication Copy. 7p.

The possibility of heating electrons by the generated electric field inside the channel is discussed. Approximate formulas for the electron energy distribution function and the mean energy are derived. The electron temperature elevation is analyzed for three types of magnetoplasmadynamic generators: continuous electrodes with transverse power extraction, segmented electrodes with transverse power extraction, and Hall generator with axial power extraction. It is shown that the continuous-electrode generator is not satisfactory for this type of electron heating and that strong electron heating is possible only when the Hall field is strong. In this case the electrons are gyrating around the magnetic field lines. Some practical limitations for MPD generators are discussed. It is concluded that nonthermal ionization by electron heating in a Hall field is possible. Either a segmented-electrode generator with He seeded with alkali or a Hall generator using Ne or Ar without seeding appear feasible. (M.P.G.)

9099 EXPERIMENTAL STUDIES OF SOME ELECTRICAL PROPERTIES OF SEEDED FLAME GASES. George E. Moore (General Electric Co., Schenectady, N. Y.). ARS Preprint 2590-62. New York, American Rocket Society, 1962. Prepublication Copy. 34p. $1.00.

Three experimental programs and some of their results are described. The conductivity of potassium-seeded, propane-oxygen flame gases was determined by simple resistance measurements, using concentric graphite electrodes in a small furnace. Approximate proportionality of the conductivity to (concentration)$^{1/2}$ was shown over the range 0.01 to almost 10 per cent K in the gas. The temperature dependence (1900° to 2400°K) corresponds satisfactorily with that expected for ionization equilibrium. Experiments were carried out with 2- by 4-inch MHD channels, using K-seeded H_2-air combustion gases at ~730 m/sec and 2100°K static temperature; the operating characteristics for both Faraday and Hall generators were measured in B-fields of 3 to 12 kgauss. Values of electron mobility were obtained in three ways and compared: from the variation of internal resistance with B for both types of generator, from the ratio of their open-circuit voltages, and from ordinary resistance measurements on the gas. Some materials problems in the operation of these generators are briefly discussed. An experimental survey was made of the electrical conductivity of flame gases resulting from seeding with various other materials; in all, 26 elements were tried, 10 of which are known to have been studied elsewhere. In addition, a number of pairs of elements were tested for enhancement effects. In general, no element or combination of elements was found which approached potassium in effectiveness as a seeding agent for application to MHD power generation. (auth)

9100 A NEW COLLECTOR OF SOLAR RADIANT ENERGY. THEORY AND EXPERIMENTAL VERIFICATION—CALCULATION OF THE EFFICIENCIES. Giovanni Francia (Università, Genoa). SAE Preprint 594B. New York, Society of Automotive Engineers, Inc., 1962. Prepublication Copy. 18p. $1.00.

The scientific bases and experimental results of a solar energy collector, which has characteristics enabling it to collect the energy of the sun at a temperature high enough for modern heat engines, are illustrated. This absorber, whose basic part consists of a honeycomb structure, has the property to let the solar energy pass through, and to stop nearly completely the reradiation of the collected thermic energy. It is light and easily packaged in small volume and, therefore, fits space vehicles, for which the only energy available is solar energy. On earth, its possible low cost might make it economically competitive with the traditional sources of energy. (auth)

9101 THE NERNST GENERATOR, A SOLID-STATE, THERMOMAGNETIC, DIRECT-ENERGY CONVERTER. M. R. El-Saden (North Carolina State Coll., Raleigh). ASME Preprint Paper No. 62-WA-26. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 9p. $1.00.

The thermomagnetic and galvanomagnetic effects present some new potentialities in the field of direct conversion of heat to electrical power. A device referred to as the "Nernst generator" operating on the Nernst and Ettingshausen effects is studied. The thermodynamic performance of the device is analyzed. The results show that there exists a dimensionless grouping of the properties of the material, called the "thermomagnetic number," which governs the suitability of a material for this application. The present-day knowledge of the properties of the material, relevant to this application, are discussed. From this discussion, it appears that, contrary to the case in thermoelectric applications, intrinsic semiconductors, within a certain range of temperature, are more promising than extrinsic semiconductors. This would permit the device to operate at higher temperatures. (auth)

9102 THE ELECTRICAL CONDUCTIVITY OF WEAKLY IONIZED GASES. PART I. Paul Molmud (Space Technology Labs., Inc., Redondo Beach, Calif.). ARS Preprint 2586-62. New York, American Rocket Society, 1962. Prepublication Copy. 25p. $1.00.

Some elementary solutions of the wave equation are obtained for electromagnetic waves in an ionized gas. The solutions demonstrate the importance of conductivity in controlling absorption. Improper computation of conductivity by conventional theory may lead to order of magnitude errors in estimating absorption. The theory of a-c conductivity for a weakly ionized gas is reviewed. It is shown when and how the exact theory may be employed in conventional form and without error. The expression for the conductivity of a weakly ionized mixture of gases is formulated and analyzed in the low, intermediate, and high pressure regions. The conductivity of the mixture is shown to be reducible to the sum of conductivities of gases of constant cross section but complex wave frequencies. Appropriate tables for the evaluation of these latter conductivities are being constructed. (auth)

9103 ELECTRICAL PROPERTIES OF ROCKET FLAMES. Thomas H. Dimmock, William R. Kineyko, and Norman Jen (Thiokol Chemical Corp., Danville, N. J.). ARS Preprint 2589-62. New York, American Rocket Society, 1962. Prepublication Copy. 7p. $1.00.

Seeded high-temperature flames in a rocket and on open burners were studied to determine whether they are a suitable medium for significant magnetohydrodynamic interactions. The plasma properties of the flames were measured by probes, microwaves, and emission spectroscopy over the pressure range 0.03 to 16.0 atm. The ionization was found to be depressed below any theoretical value that did not consider chemical attachment processes. When the ionization of the flame was $10^{11}/cm^3$ or less, an electric field intensity as high as 1.5 v/cm could be impressed on the plasma by external electrodes. This is enough to produce deflection of slow-moving flames in external electric fields. If the mole fraction of ionization is above 10^{-4}, the flame is unsuitable for electrostatic deflection but may be suitable for a Lorentz field deflection. The forces produced by reasonable-sized Lorentz

fields are not comparable with those produced by thermal expansion in a rocket nozzle. (A.G.W.)

9104 A SURVEY OF TECHNIQUES FOR PREDICTING THE SPACE OUTPUT OF PHOTOVOLTAIC DEVICES. K. L. Hanson (General Electric Co., Philadelphia). ASME Preprint Paper No. 62-WA-194. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 8p. $1.00.

Major problem areas in predicting the output of photovoltaic power supplies for space vehicles are identified. The accuracy requirements are defined, and present methods of prediction are described and evaluated with respect to the requirements. It is concluded that refinement of present methods will be sufficient for future needs, but correlation and additional high-altitude experimentation are needed. (auth)

9105 RELIABLE SOLAR POWER SUPPLY DESIGN. I. Doshay and W. F. Emrich. SAE Preprint 580C. New York, Society of Automotive Engineers, Inc., 1962. Prepublication Copy. 7p. $1.00.

An analysis is made of a power supply system design for an orbiting spacecraft. Two designs are developed for a highly reliable solar power supply, both of which encompass redundant components. Reliability estimates are developed. Conclusions are reached on the alternative with the most advantageous performance and reliability characteristics. Details of the improvement in reliability resulting from various techniques in design are given, as are the calculations involved. The number of solar cell modules required to satisfy power-usage requirements at a given reliability level is also developed; this includes consideration of the effects of meteoroid bombardment and Van Allen Radiation. (auth)

9106 RECENT DEVELOPMENTS IN NEUTRON SOURCE STANDARDIZATION. R. S. Caswell, R. H. Noyce, S. B. Garfinkel, and E. R. Mosburg, Jr. (National Bureau of Standards, Washington, D. C.). IAEA Preprint SM-36/80. 9p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Three recent developments in the area of neutron source standardization are: (1) a new absolute measurement of the neutron emission rate of the US national standard neutron source, a Ra-Be (γ,n) source called NBS-I, has been made using a manganous sulfate bath of primarily heavy water, which is less dependent on values of neutron absorption cross sections than previous bath methods; (2) the Pu^{239}-Be(α,n) source, although convenient to use, has turned out not to be a satisfactory standard neutron source due to contamination from Pu^{241} in the available supplies of Pu^{239}, leading to an undesirably large and uncertain rate of growth in neutron emission versus time for a particular source due to growth of the alpha emitter, Am^{241}; (3) the recent release of Am^{241} by the USAEC gives promise of a convenient, intense source of neutrons without the disadvantages of the Pu^{239}-Be(α,n) source. The absolute calibration of a neutron standard source may be thought of as an absolute counting determination, combined with a correction due to the relative probabilities of neutron reactions leading to the event which is absolutely measured compared to the probability of competing events which do not lead to the desired reaction. When a manganous sulfate bath is used with light water, the probability of $Mn^{55}(n,\gamma)Mn^{56}$ leading to the desired Mn^{56} radioactivity is of the same order of magnitude as the probability of neutron absorption by hydrogen, sulfur, and other elements present. The correction for absorption by the undesired reactions is large and strongly dependent on knowledge of the appropriate absorption cross sections. Use of a manganous sulfate bath which is primarily heavy water, has permitted a recalibration of the natural standard neutron source with increased accuracy because of the much smaller hydrogen content of the bath. An Sb-Be(γ,n) source was absolutely calibrated in the heavy water bath, and NBS-I was calibrated by a relative comparison to the Sb-Be(γ,n) source in a light water manganous sulfate bath. Results are presented and intercomparisons to other national standard neutron sources shown. Information on the growth of neutron emission rate with time for several Pu^{239}-Be neutron sources is presented. The growth rates are of the order of 1% a year, but vary widely. (auth)

9107 STUDIES OF METAL–WATER REACTIONS BY THE EXPLODING WIRE TECHNIQUE. Louis Baker, Jr. and Raymond L. Warchal (Argonne National Lab., Ill.). p.207-23 of "Exploding Wires, Vol. 2." New York, Plenum Press, Inc., 1962.

The exploding wire technique was used as a method of studying chemical reactions between molten metals and water. Research was directed toward heating a maximum quantity of metal to an accurately known temperature in a range of interest in chemical studies. Two methods of measuring the energy imparted to a specimen wire by discharging condensers were developed. Both methods involved the use of short lengths of constantan wire in the discharge circuit. Small thermocouples, attached to the constantan wires, provided a direct measure of the "action integral." Suitable calibration procedures made it possible to calculate specimen wire temperature to within 100°C. The estimate of accuracy was proved by (1) the correlation between calculated temperature and indications of melting for two sizes of zirconium, uranium, and platinum wires, and (2) the reproducibility of the observed extent of metal–water reaction. High-speed motion pictures of wire disintegrations indicated that heating was uniform over the length of the wire. Wires heated only slightly above the melting point required considerable time beyond the current cutoff to disintegrate into particles. Average particle diameters were measured and found to decrease uniformly with increasing metal temperature. Uniform heating occurred with zirconium, uranium, platinum, and stainless steel. Aluminum wires broke in a few places; the remaining energy was dissipated as arcs. Preliminary studies of the zirconium–water reaction included measurements of pressure transients and the quantity of hydrogen generated by reaction. Studies were made with metal temperatures from 1100 to 4000°C and with water temperatures from 25 to 315°C. Results indicated that the exploding wire technique is well suited for accurate chemical studies between metals and nonmetallic fluids. (auth)

9108 VARIATIONAL PRINCIPLES IN DYNAMICS AND QUANTUM THEORY. SECOND EDITION. Wolfgang Yourgrau and Stanley Mandelstam. London, Sir Isaac Pitman & Sons, Ltd., 1960. 188p.

An historical review is given of classical variational principles and methods, culminating in an outline of the Hamiltonian and Lagrangian formalisms and contact transformations. The Hamiltonian formalism is applied to electrodynamics. The use of variational methods in quantum and wave mechanics is examined. The principles of Feynman and Schwinger in quantum mechanics are studied. (T.F.H.)

9109 THIN FILM CdS FRONT WALL SOLAR CELLS. F. A. Shirland, T. A. Griffin, and G. H. Dierssen (The Harshaw Chemical Co., Cleveland). ARS Preprint No. 2566-

62. New York, American Rocket Society, 1962. Prepublication Copy. 7p. $1.00.

A photovoltaic cell made from a film of CdS vacuum-evaporated onto a metal foil substrate is described. Such cells are made in sizes up to 3 × 3 in., at conversion efficiencies of 2 to 3%. They can be laminated in plastic envelopes to form arrays delivering 10 to 15 watts per pound. It is estimated that these cells can be made very economically. Typical I-V characteristic, spectral response, and temperature performance curves are given. Data on the stability of these front wall CdS cells, including resistance to radiation damage, are also presented. Possibilities for larger-area, lighter-weight, higher-efficiency cells of this design are discussed. (auth)

9110 15 KW ADVANCED SOLAR TURBO-ELECTRIC CONCEPT. Kenneth E. Nichols (Sundstrand Aviation-Denver, Denver). ARS Preprint No. 2501-62. New York, American Rocket Society, 1962. Prepublication Copy. 44p. $1.00.

Development work carried out on various components and subsystems of a 15-kilowatt solar dynamic power system designed for continuous operation for at least one year in earth orbit is described. Also included is a brief summary of future development plans. (auth)

9111 COMPARATIVE ANALYSIS OF FUEL CELL, SOLAR CELL, AND CRYOGENIC CHEMICAL DYNAMIC SPACE POWER SYSTEMS FOR INTERMEDIATE DURATION MISSIONS. H. A. Schulte, Jr., J. H. Tarter, and R. G. Roble (The Bendix Corp., Southfield, Mich.). ARS Preprint No. 2524-62. New York, American Rocket Society, 1962. Prepublication Copy. 9p. $1.00.

The description, operating characteristics, advantages, disadvantages, and problem areas of fuel cell systems, solar cell systems, and cryogenic chemical dynamic systems are discussed. System parameters are defined for power levels up to 5 kilowatts and for space mission durations up to 14 days. The limitations of each system are discussed and the system characteristics compared. The fuel cell systems consist of a hydrogen-oxygen fuel cell battery utilizing supercritical cryogenic fuel storage. Three systems are analyzed: a partially integrated system in which the products of reaction are recovered for use as crew water; a nonintegrated hydrogen-cooled system; and a nonintegrated radiator-cooled system. Two solar cell systems are discussed: a pure solar cell system designed for 100 percent daylight operation; and a solar cell battery system designed for 60 percent daylight operation. The cryogenic chemical dynamic systems utilize supercritical hydrogen and oxygen, which is reacted, and the hot gases used to drive a prime mover and generator. Two systems are analyzed: a completely integrated system using cryogenic hydrogen for power and all environmental cooling; and a partially integrated system using cryogenic hydrogen for power and partial environmental cooling. (auth)

9112 ENERGY STORAGE IN SUPERCONDUCTING MAGNETIC COILS. William F. Hassel (U. S. Naval Ordnance Test Station, China Lake, Calif.). ARS Preprint No. 2506-62. New York, American Rocket Society, 1962. Prepublication Copy. 8p. $1.00.

An inductance coil made of superconducting wire, maintained at the temperature of liquid helium, is considered as a means of electrical energy storage. A method is described for obtaining an effective d-c output from discharge of such a coil. Optimization of the coil design for maximum energy storage yields energy-per-unit-volume figures in the range of 2×10^8 to 2×10^9 joules/m^3. The energy-per-unit-weight is comparable to that of batteries. The chief advantage of inductive energy storage is the capability of providing a power output greatly exceeding that of a battery of the same weight. (auth)

9113 THERMAL ENERGY STORAGE FOR THERMIONIC CONVERSION. E. F. Batutis and D. L. Purdy (General Electric Co., Valley Forge, Pa.). ARS Preprint No. 2505-62. New York, American Rocket Society, 1962. Prepublication Copy. 72p. $1.00.

Silicon and a number of refractory oxide mixtures were studied in an investigation of materials having the properties of high heat of fusion (weight basis) and melting temperatures ranging from 1600 to 2200°K. These thermal energy storage (TES) materials were examined for usage in solar collector-thermionic converter electrical power systems employed in space vehicles. A series of screening tests for silicon containment materials indicated that pyrolytic graphite, boron nitride, titanium boride and several other materials might be useful. Alternate TES materials in the form of eutectic oxides were found that had heats of fusion near or better than silicon. Fabrication and sealing problems of the silicon container materials shifted emphasis to the oxides. A system study was undertaken using the oxides as part of a solar thermionic electric power system. Calculated specific system weights ranged from 185 to 285 pounds per kilowatt with $4BeO-4MgO-Al_2O_3$ and $3BeO-2CaO$ respectively. The higher operating temperatures possible using oxides was the major parameter resulting in specific system weights lower than that calculated for silicon. (auth)

9114 SOLAR-CELL POWER SYSTEMS TESTING. John A. Zoutendyk (Jet Propulsion Lab., Pasadena, Calif.). ARS Preprint No. 2504-62. New York, American Rocket Society, 1962. Prepublication Copy. 44p. $1.00.

A facility for testing large solar-cell panels is described. Since solar cells are spectrally selective devices, the change in the Sun's spectrum from Earth to space makes it necessary to apply correction factors to the panel efficiencies measured on Earth in order to obtain the efficiencies in space. This spectral correction factor is dependent on both the spectral response of the solar cells being measured and the spectral distribution of the light under which they are measured. Therefore, a method for determining the value of this factor at the time at which a solar-cell power array is measured is needed. In order to control the space output of solar panels, the output of individual solar cells in space must be determined before they are placed in a large array. Because the number of cells to be measured is large, these tests are best done in the laboratory. This requirement gives rise to the need for a laboratory light source that has both the spectral and total intensity of the Sun outside the Earth's atmosphere. A specification for such a light source is noted. However, the method of calibrating such a light source is still undefined. The best calibration could be effected with the use of standard solar cells whose short-circuit current in space is known. The use of high-altitude balloon flights in determining the Earth space short-circuit current of solar cells is discussed. The application of balloon flight measurements to the determination of solar-cell spectral correction factors is outlined. (auth)

9115 SOLAR CELLS DESIGNED FOR OPERATION IN THE INNER REGIONS OF THE SOLAR SYSTEM. M. F. Lamorte (Radio Corp. of America, Somerville, N. J.). ARS Preprint No. 2568-62. New York, American Rocket Society, 1962. Prepublication Copy. 5p. $1.00.

Resistive losses in solar cells become quite large for high incident flux levels. A method is described, consisting in the addition of a grid-structure contact to the top surface of the cell, for reducing these losses in regions where the

incident intensity is 1 w/cm^2 or more. The grid dimensions are determined by the anticipated flux level. This method is shown to be capable of increasing the efficiency of a solar cell, at 1 w/cm^2 incident intensity, from about 50% to about 97% of the theoretical power output. (T.F.H.)

9116 A NEW RADIATION DAMAGE RESISTANT SOLAR CELL. S. Kaye, I. Weiman, and W. V. Wright (Electro-Optical Systems, Inc., Pasadena, Calif.). ARS Preprint No. 2567-62. New York, American Rocket Society, 1962. Prepublication Copy. 23p. $1.00.

The design and performance of an experimental silicon p-n junction solar cell intended for space application is described. The cell has an n-type surface layer and an impurity gradient in the p-type base region. The gradient provides an electric field in the base region that accelerates photoelectrons into the vicinity of the p-n junction. By this means the dependence of the short circuit current upon the minority carrier lifetime is reduced. Since this latter parameter is the one most affected by bombardment of the cell by energetic charged particles, the tolerance of the cell to damage by such particles is considerably enhanced. Data are presented on the performance of these cells as a function of high-energy electron and proton irradiation levels. (auth)

9117 CESIUM THERMIONIC CONVERTERS AND GENERATORS FOR SOLAR SPACE POWER SYSTEMS. Pierre J. Brosens and Sotiris S. Kitrilakis (Thermo Electron Engineering Corp., Waltham, Mass.). ARS Preprint No. 2571-62. New York, American Rocket Society, 1962. Prepublication Copy. 9p. $1.00.

Data obtained for converters using niobium, tantalum, tungsten, iridium, and rhenium emitters, as a function of interelectrode spacing and converter operating temperatures, is given in the form of maximum power density maps. Theoretical work on the effect of crystallographic orientation of emitter surface on converter performance is described. General design requirements for solar thermionic generators for space applications are discussed. Generators can be designed to have the fast warm-up characteristics that must be achieved in satellite applications. Work on cylindrical monodiode and cubical multidiode generators is described. Although no inherent limitation is observed on the life and reliability of thermionic devices, life of the order of several thousands of hours and high reliability remain to be demonstrated. (auth)

9118 TELSTAR STELLITE POWER SYSTEM. Robert E. D. Anderson (Bell Telephone Labs., Inc., New York), Edward A. Hake, and David Feldman. ARS Preprint No. 2503-62. New York, American Rocket Society, 1962. Prepublication Copy. 21p. $1.00.

In addition to the communications receiver and transmitter, Telstar contains several radiation experiments and a number of subsystems for acquisition and control. The power drains for the various loads are operated on different duty cycles, reaching a peak load of about 24 watts. The satellite power system design is severely constrained by requirements of long life (one to two years), minimum size and weight, and extreme radiation exposure. A solar cell, nickel-cadmium battery power system is selected, utilizing silicon n-on-p solar cells and special nickel-cadmium cells. Power conversion circuitry is designed to perform at maximum possible efficiency. The battery bus voltage variations are regulated to a common minus 16-volt bus by means of a solid-state regulator. High voltages for the traveling wave tube are obtained from this bus by means of a solid-state converter circuit. In view of the space and weight limitations, emphasis is placed on extremely reliable components and circuitry rather than on redundant systems. (auth)

9119 ELECTROSTATIC POWER GENERATORS FOR SPACE. C. Coenraads, A. S. Denholm, J. Lavelle, and F. McCoy (Ion Physics Corp., Burlington, Mass.). ARS Preprint No. 2555-62. New York, American Rocket Society, 1962. Prepublication Copy. 32p. $1.00.

The development of electrostatic generators that combine low weight with electromechanical stability and flashover elimination is discussed. Power/mass ratios better than 0.5 kw/lb can be obtained at 20 kv output voltage, and these ratios become lower as the output voltage decreases. (T.F.H.)

9120 CONSTANT OBLIQUE FIELD ELECTROSTATIC GENERATOR. Dominique Gignoux (Cosmic, Inc., Washington, D. C.). ARS Preprint No. 2556-62. New York, American Rocket Society, Prepublication Copy. 5p. $1.00.

A class of disc-type electrostatic generators, having rod-shaped rotors (perhaps imbedded in a dielectric) and semiconducting stator blades, is described. The favorable characteristics of the oblique-field configuration thus formed are outlined. Power outputs of this type of machine are noted. (T.F.H.)

9121 STATUS OF SOLAR ENERGY COLLECTOR TECHNOLOGY. Atwood R. Heath, Jr. (NASA Langley Research Center, Hampton, Va.). ARS Preprint No. 2531-62. New York, American Rocket Society, 1962. Prepublication Copy. 10p. $1.00.

A summary is made of the efficiency, concentrating ability, unit weight, and packaged volume of solar energy collectors of the Fresnel, inflatable, rigidized inflatable, one-piece, petal, and umbrella types. (T.F.H.)

9122 COLLOIDAL ELECTROHYDRODYNAMIC ENERGY CONVERTER. A. Lucile Cox (Ion Physics Corp., Burlington, Mass.). ARS Preprint No. 2559-62. New York, American Rocket Society, 1962. Prepublication Copy. 10p. $1.00.

The colloidal electrohydrodynamic energy converter described changes the thermal energy of a slightly ionized superheated vapor to directed kinetic energy, then to high-voltage electric energy. High conversion efficiency is possible if neutral atoms can be made to condense on the ions. The neutral atoms increase the momentum of the ions, which are being pushed against a retarding electric field. Radiation and radiator requirements of the system are noted. The electric power output attainable should be better than 0.4 kw/lb at 500 kw. Use of the system for propulsion and internal power for spacecraft is discussed. Performance of Hg, K, Na, and Li are working fluids is described. (T.F.H.)

9123 SUPERCRITICAL CRYOGENIC HYDROGEN AND OXYGEN STORAGE SYSTEMS FOR DIRECT ENERGY CONVERTER REACTANT SUPPLY IN MANNED SPACECRAFT. J. A. Potter and J. S. Tyler (AiResearch Mfg. Co., Los Angeles). ARS Preprint No. 2515-62. New York, American Rocket Society, 1962. Prepublication Copy. 24p. $1.00.

An outline is given of the description and operation of supercritical cryogenic systems for storing gases in space vehicles. Considerations of weight, thermodynamics, insulation, delivery rates, materials of construction, fluid delivery rates, and heat leaks are discussed. Data are given for H_2, O_2, and N_2. (T.F.H.)

9124 A HIGH PERFORMANCE, SHORT TIME DURATION, MHD GENERATOR SYSTEM. A. Sherman (General Electric Space Science Lab., Valley Forge, Pa.). ARS

Preprint No. 2558-62. New York, American Rocket Society 1962. Prepublication Copy. 14p. $1.00.

The potential performance of a chemically fueled MHD generator operating on an open cycle is considered. Chemical fuels other than fossil are considered. By appropriately selecting ultra-high-temperature fuels, extraordinarily high power densities can be achieved. A theoretical inviscid analysis is carried out of the channel flow for such a generator in order to determine its size, geometry, and weight. Calculations show that relatively modest magnetic fields are permissible so that appropriate configurations of permanent magnets are considered for this application. Some estimates are made of the weight of such a permanent magnet system. Consideration is also given to the heat transfer caused by the extraordinarily high gas temperatures. Tentative conclusions are that the heat loss in such generators can be handled by a combination of regenerative and radiative cooling. From theoretical calculations and estimates the fuel-plus-oxidizer flow rate for such an MHD generator seems to be in the range of 3 kg/kwh, while the specific weights range from 6 to 3 kg/kw for the larger sizes. A number of potential applications for such an MHD generator system are discussed. (auth)

9125 DEVELOPMENT OF A CONCENTRATING PHOTOVOLTAIC POWER GENERATOR. Donald H. McClelland (Electro-Optical Systems, Inc., Pasadena, Calif.). ARS Preprint No. 2497-62. New York, American Rocket Society, 1962. Prepublication Copy. 13p. $1.00.

The power output of a solar cell panel can be increased by the use of auxiliary reflectors or other types of optical concentrating devices. The use of concentration with solar cell systems is discussed and is contrasted with the situation for high temperature solar power converters involving heat engines. Theoretical performance and weight estimates are given for various configurations of concentrating photovoltaic systems. Design and selection of components and materials are discussed, including cells, cell panels, concentrators, filters, and coatings. A 50-watt ground test model is described and experimental performance results are given. (auth)

9126 SOLAR ENERGY THERMIONIC CONVERSION SYSTEM. W. R. Menetrey (Electro-Optical Systems, Inc., Pasadena, Calif.) and A. Smith. ARS Preprint No. 2499-62. New York, American Rocket Society, 1962. Prepublication Copy. 100p. $1.00.

The design, fabrication, and testing of solar-energy thermionic cells are described. The discussion includes the fabrication and performance of a 5-ft solar concentrator, fabrication and test of converters, and the fabrication of two thermionic generators along with test data using both solar radiation and electron bombardment heaters. A system efficiency of 3 percent and a specific weight of 2 watts/lb are demonstrated in a prototype system test using solar radiation. (auth)

9127 THE DESIGN OF THE UNITED KINGDOM SCIENTIFIC SATELLITE SOLAR POWER SYSTEM. Fred C. Yagerhofer (Goddard Space Flight Center, Greenbelt, Md.). ARS Preprint No. 2498-62. New York, American Rocket Society, 1962. Prepublication Copy. 26p. $1.00.

The electrical power system used in the International Ionospheric Satellite (S-51) jointly sponsored by the United Kingdom and the United States is described. The satellite employs a flat solar-cell configuration rather than the shingled-modular type, and utilizes an electrochemical cell as a one-year payload cut-off timer. Of particular note are the techniques used to obtain proper charge rate into the rechargeable nickel-cadmium batteries, the standby battery with automatic switching circuitry, and the precision static d-c to d-c conversion equipment. (auth)

9128 A MODULAR SOLAR THERMOELECTRIC POWER SUPPLY SYSTEM. Ronald Lang and Barry Lubin (United Aircraft Corp., Windsor Locks, Conn.). ARS Preprint No. 2574. New York, American Rocket Society, 1962. Prepublication Copy. 6p. $1.00.

Review is presented of a modular solar thermoelectric power supply system, which includes thermal energy storage and orientation devices. Incorporation of concepts outlined is expected to satisfy some long-life requirements of communication and weather satellites. A comparison of thermal storage with other systems for supplying continuous power is presented. (auth)

9129 LARGE, LOW-COST THERMIONIC SOLAR CONCENTRATOR ANALYSIS AND DEVELOPMENT. John P. Bagby, Robert C. Erdmann, and Oscar Biblarz (Hughes Aircraft Co., Culver City, Calif.). ARS Preprint No. 2534-62. New York, American Rocket Society, 1962. Prepublication Copy. 56p. $1.00.

Analysis and computer studies show that collectors of other than paraboloidal conic sections of revolution, used for solar concentrators, can achieve sufficient intensities to produce emitter temperatures required for satisfactory thermionic energy conversion. Lightweight solar concentrators of any conic of revolution are formed without masters by inflating and stretching aluminized mylar film prior to foam rigidization. The mathematical analysis of second-degree conic concentrators is presented. The fabrication techniques and optical performance tests used are described. A mosaic method of manufacturing very large, low-cost concentrators is investigated. (auth)

9130 THERMIONIC CAVITY GENERATOR DEVELOPMENT. David L. Purdy (General Electric Co., Philadelphia). ARS Preprint No. 2572-62. New York, American Rocket Society, 1962. Prepublication Copy. 49p. $1.00.

Work performed on a cavity vapor generator is discussed, and attention is given to the expected performance of future solar-thermionic space-power systems. The system considerations involved in collector and generator sizing, as well as converter-to-generator relationships, are discussed. Computations are described that define the thermal and electrical performance of the converters, cavity, insulation, collector, and vacuum system. Measured values of thermal energy and electrical power obtained during laboratory testing are described, resulting in a converter efficiency at a cathode temperature of 1650°K of 6.5%. A description of a solar test and expected solar test results is included. (auth)

9131 CALIBRATION OF SOLAR CONCENTRATOR FOR USE IN POWER SYSTEM RESEARCH. Floyd A. Blake (General Electric Co., Philadelphia). ARS Preprint No. 2528-62. New York, American Rocket Society, 1962. Prepublication Copy. 27p. $1.00.

Experimental calibration of a rigid solar collector is described. Evaluation of the geometry by optical inspection, of energy collection by calorimeter measurements, and of energy intensity by radiometer tests, is discussed. The effect of necessary accessories on the concentrator performance is presented. These accessories include the tracking system, vacuum-chamber window, and focal-plane mounting hardware. The effects discussed include: determination of collection efficiency as a function of misorientation angle, from 0 to 24 minutes misoriented; transmissivity losses and focused-energy distortion introduced by vacuum-chamber windows; and efficiency as a function of axial position. Flux distribution results, in planes per-

pendicular to the optical axis and on cylinders around the optical axis, are discussed. Two methods of flux distribution determination are utilized and compared. These are the incremental-energy method using a water calorimeter, and a point-by-point method using a radiometer. (auth)

9132 FLAT PLATE SOLAR THERMOELECTRIC GENERATOR SYSTEM CONCEPT. Charles W. Glassburn (Wright-Patterson Air Force Base, Ohio). ARS Preprint No. 2573-62. Prepublication Copy. 7p. $1.00

Details are presented of flat-plate solar-thermoelectric generator research results, and the concept operation discussed from a systems standpoint. System factors and potentials are estimated, assuming the concept to be developed to the point where operational feasibility is established. (auth)

9133 SUNFLOWER THERMO-DYNAMIC POWER SYSTEM DEVELOPMENT STATUS. J. A. Rudy and J. W. Picking (Thompson Ramo Wooldridge Inc., Cleveland). ARS Preprint No. 2502-62. New York, American Rocket Society, Prepublication Copy. 9p. $1.00.

The status of the components that comprised the Sunflower system was summarized. The major components of the system successfully underwent static ground performance testing with the exception of the full scale solar collector. Confirmation was obtained on the turbo-alternator, one copy of which accumulated more than 2000 hours of continuous operation. Specification and system design changes were identified that offered significant performance improvements. Preliminary designs were accomplished that indicated straightforward reduction to 87 lbs/kw, and developmental capability for further reduction to 63 lbs/kw at 15 kw, for 300-n.m. orbits. (auth)

9134 PERFORMANCE TEST OF A CUBICAL CAVITY SOLAR THERMIONIC GENERATOR. W. J. Leovic, M. W. Mueller, and C. G. Stevenson (Thompson Ramo Wooldridge Inc., Cleveland). ARS Preprint No. 2554-62. New York, American Rocket Society, 1962. Prepublication Copy. 11p. $1.00.

A solar test program carried out on a prototype thermionic generator is described. The program, which is designed to evaluate the performance of the generator in conjunction with a five-foot precision solar concentrator, shows the ability of such a combination to produce very nearly its design power output levels in a space environment. A description is given of all specialized equipment and techniques employed in carrying out the tests and evaluations. The pertinent data and results are summarized and analyzed for all major phases of the solar test effort. These major phases include the evaluation of concentrator efficiency, flux profile and power distribution measurements, cavity absorber efficiency, the environmental chamber and the influence of the transparent vacuum enclosure, a comparison and correlation of solar test generator performance with laboratory test data, and an extrapolation of the earth-bound test results to the true space environment. (auth)

9135 SELECTIVE RADIATION PROPERTIES OF PARTICULATE COATINGS. D. A. Williams, T. A. Lappin, and J. A. Duffie (Univ. of Wisconsin, Madison). Preprint Paper No. 62-WA-182. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 1962.

The variation with wavelength of thermal radiation properties of coated surfaces is important for solar energy absorbers and in other applications, and depends on the optical properties of the coating material and the substrate, and on the structure of the coating. Theoretical considerations indicate that, for homogeneous coatings, the good optical properties of semiconductors can be improved if the coating contains a high fraction of voids. This improvement is shown by experimental particulate PbS coatings which are not homogeneous; the selective properties of particulate coatings are better than those calculated for solid coatings at the same coating weight. PbS coatings on aluminum substrates show absorbances for solar radiation of 0.9 and long wave emittance of 0.2 to 0.3. The feasibility of selective paints is demonstrated; PbS can be mixed with a transparent binder, silicone, to make a paint which shows a good degree of selectivity, and absorbances of 0.9 and emittances less than 0.4 are obtained. (auth)

9136 THE STRUCTURE OF FIELD SPACE. An Axiomatic Formulation of Field Physics. Dominic G. B. Edelen. Berkeley and Los Angeles, University of California Press, 1962. 251p. $10.50.

The theory of the structure of field theories is presented in an axiomatic approach, starting from a (supposedly) minimal set of axions. This "theory of variant fields" delineates the results produced by the mathematical nature of the problem and those forced by additional physical assumptions. This variant theory is used in conjunction with several specialized Lagrangian functions to obtain classical field theories in order to demonstrate the adequacy of the variant theory. (T.F.H.)

9137 ADVANCES IN APPLIED MECHANICS. VOLUME 7. H. L. Dryden and Th. von Kármán, eds. New York, Academic Press Inc., 1962. 333p. $11.00.

Four review articles are included: a separate abstract has been prepared for one. The articles not abstracted separately cover such topics as: hypersonic flow over slender bodies associated with power-law shocks; theory of equilibrium cracks in brittle fracture; and plasticity under non-homogeneous conditions. (T.F.H.)

9138 SOME ELEMENTARY PROBLEMS IN MAGNETO-HYDRODYNAMICS. Raymond Hide and Paul H. Roberts (Univ. of Durham, Newcastle-upon-Tyne, Eng.). p.215-316 of "Advances in Applied Mechanics. Vol. 7." New York, Academic Press Inc., 1962.

A review is given of the basic equations of magnetohydrodynamics (MHD), electromagnetic and mechanical effects in MHD, dimensionless parameters of MHD systems, boundary conditions, plane and Alfvén waves, gravitational waves and instabilities, and steady and non-steady MHD flows. (T.F.H.)

9139 SIMPLE, ANALYTIC ATOMIC WAVE FUNCTIONS WITH APPLICATION TO CESIUM. Charles Henry Sherman. Thesis, Storrs, Conn., Univ. of Connecticut, 1962. 84p.

A new method is presented for the determination of analytic, one-electron wave functions for an electron in an approximately self-consistent screened Coulomb field. The method, which requires relatively small effort, does not require direct numerical solution of the Schroedinger equation. Instead, for each state two parameters are adjusted to make a certain expression for the screening function approximate the Thomas-Fermi screening function for the atom in question. When this is done, a simple, analytic expression for the eigen function is obtained, along with the corresponding energy eigenvalue for that state. Such wave functions are obtained for all of the lower excited states of cesium as well as the normally filled states of potassium. The analytic wave functions thus obtained are simple enough so that approximate expectation values of certain quantities can be easily calculated by analytic

methods. As a first illustration of the methods the normalization constants for several of the cesium states are calculated. Then the fine structure and hyperfine structure energy splittings of cesium are calculated. The calculation of transition probabilities is also considered, and the calculation is carried out for the 6s–6p transition of cesium. The results of the calculations usually agree well with experimental values and with other calculations, which indicates a high degree of validity for the wave functions. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9140 LIE DERIVATIVES AND THE CAUCHY PROBLEM IN THE GENERAL THEORY OF RELATIVITY. John Jay Stachel. Thesis, Hoboken, N. J., Stevens Inst. of Tech., 1962. 93p.

The Cauchy problem in the general theory of relativity, in both a metric and a tetrad formulation, is treated with the help of the Lie derivative. A more geometrically intuitive and covariant treatment of a number of problems is thereby achieved. Expressions for the evolution of the hypersurface metric on a family of geodesically parallel hypersurfaces in an arbitrary Riemann space are given. When the field equations are imposed, the role of various components of the Riemann tensor with respect to the surface and normal directions in determining this evolution is shown. An interpretation of the constraint equations is developed that reduces their solution to the problem of embedding two hypersurfaces with arbitrary metrics into a Riemann space with vanishing Ricci tensor. The problem of continuing the hypersurface metric on an arbitrary family of hypersurfaces is solved. A Lagrangian and Hamiltonian formulation of the problem for geodesically parallel hypersurfaces is given in terms of Lie derivatives. (Dissertation Abst., 23: No. 5, Nov. 1962)

9141 THE SCATTERING OF A POTASSIUM ATOMIC BEAM BY A CROSSED BEAM OF BROMINE MOLECULES. Richard William Roberts. Thesis, Providence, R. I., Brown Univ., 1960. 166p.

A study was made of the scattering of crossed molecular beams for the determination of information on intermolecular forces and chemical reaction cross sections. A high resolution molecular beam apparatus was constructed to study the interaction of a monoenergetic beam of potassium atoms with a crossed beam of bromine molecules. The device incorporates resistance heated ovens, a helical mechanical velocity selector, and a differential surface ionization detector which distinguishes between potassium and potassium bromide. The construction and performance of this apparatus are discussed in detail. Preliminary experiments with beams of potassium and potassium bromide yielded ionization efficiency vs detector filament temperature curves for the two detector wires (tungsten and 92% platinum–8% tungsten wires) and confirmed the observation that potassium can be distinguished from potassium bromide with such a detector. By varying the speed of rotation of the mechanical velocity selector the velocity distribution of potassium atoms effusing from the oven could be measured. The results agree with theoretical results predicted on the basis of effusive flow and a Maxwell-Boltzmann velocity distribution in the oven. During the course of the experiments it was observed that the shape of a wide (0.020 in.) potassium beam profile depended on the speed of rotation of the velocity selector. It was also observed that small intensity satellite peak appeared around the main potassium peak. These two effects were shown to be caused by the geometry of the apparatus. Total collision cross sections for potassium plus bromine as a function of the potassium velocity were determined for potassium beams with velocities in the range from 2.2×10^4 cm/sec to 14.3×10^4 cm/sec. The experimental value of the total collision cross section is about one third the value calculated with the theory of Massey and Mohr, which assumes that scattering is due only to London dispersion forces. For example, the measured total collision cross section for potassium (velocity = 6.3×10^4 cm/sec) plus bromine (T = 215°K) is 263×10^{-16} cm^2 and the calculated total cross section is 832×10^{-16} cm^2. A part of the discrepancy may be due to a possible error in the estimation of the effective bromine concentration at the scattering region. The variation of the total collision cross section with relative velocity agrees within the experimental scatter with the predicted variation assuming an attractive potential resulting from London dispersion forces. A number of experiments were performed to ascertain whether any potassium bromide was formed as a result of collisions between potassium and bromine. No potassium bromide could be detected above the background noise level of about 2 to 5×10^{-14} ampere (on the 0.002 in. diameter detector wire) over the whole range of angles. The maximum flux of an unvelocity selected beam of potassium atoms at the scattering region was about 2×10^{12} molecules/cm^2/sec, and the effective bromine concentration at the scattering region was about 1.4×10^{12} molecules/cm^3. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9142 THE PHOTOELECTRIC K-ABSORPTION CROSS SECTION OF HELIUM AND LITHIUM. Donald James Baker, Jr. Thesis, Ithaca, N. Y., Cornell Univ., 1962. 66p.

The photoelectric absorption cross section in the vicinity of the K-edge of helium and lithium was measured. The K-edges of the elements lie in the soft x-ray region and special care was necessary in order to determine the absolute value of the absorption cross section. The absorption cross section of helium was measured in the spectral region extending from 180 to 600 Å with greater accuracy. A grazing incidence spectrometer with a photomultiplier was used for a single measurement at 180 Å while the remaining measurements were carried out in a normal incidence spectrometer utilizing photographic techniques. The gas was confined to a small cell provided with sufficiently transparent windows. The use of an absorption cell reduces the contamination and facilitates the measurements of gas pressures. The results indicate that the cross section varies from a value of 0.98 ± 0.04 mb at 180 Å to a value of 7.7 ± 0.3 mb at the absorption edge located at 504 Å. The photoelectric absorption cross section of metallic lithium was measured in the spectral region extending from 80 to 280 Å. The wavelength dependence deduced from the experiment is in general agreement with that reported by others. A more refined technique made it possible to determine the absolute value of the cross section. Theoretical calculations of the atomic cross section were also carried out and the results compare favorably with observation. The absorption measurements were carried out with a minimum of risk of contamination. The surface densities of the thin absorbing films used were determined by observing the change of resonant frequency of a quartz crystal as lithium vapor was evaporated onto it. Spectrograms were obtained for different values of the surface density. The internal agreement of the results provided an indication of the consistency of the crystal monitor. The cross section reached a maximum of 2.60 ± 0.3 mb at an incident photon wavelength of 193 Å. (P.C.H.)

9143 OSCILLATION OF TWO CYLINDERS IN LIQUID HELIUM II. Robert Gregory Hussey. Thesis, Baton Rouge, La., Louisiana State Univ., 1962. 104p.

The added mass and damping of two circular cylinders oscillating in liquid helium II were observed by means of a torsion pendulum and compared with a viscous fluid theory. The cylinders were made from Lucite rods (0.32 cm radius) and constrained to move with their axes parallel to and equidistant from the axis of rotation by means of Lucite end plates. The influence of the two cylinders on each other and the effect of a rigid cylindrical boundary were determined by an ideal fluid calculation, which showed that the added mass of each cylinder must be multiplied by a boundary factor, F, the principal terms of which are: $F = 1 - (r_1^2)/(2a^2) + (8r_1^2a^2b^4)/(b^4 - a^4)^2$. In this expression r_1 is the radius of each cylinder, a is the distance of each cylinder from the axis of rotation, and b is the radius of the boundary. In the experiment $a/r_1 \approx 5$ and $8.6 < b/r_1 < 11$. The use of liquid helium allows a wide range of parameters. The product of density and viscosity of the normal fluid varies by a factor of 25 from 2.15°K to 1.20°K. Expressions for the logarithmic decrement and the added moment of inertia were obtained by combining solutions of the Navier-Stokes equation for translating cylinders and for oscillating disks. The observed logarithmic decrement is in excellent agreement with the theoretical expression for all of the experiments. The observed added moment of inertia was about 2% less than predicted; this discrepancy is thought to be due to an end effect. When end plates of larger radius were used, the discrepancy vanished for the shortest period (2.3 sec), but as the period was increased (up to 19 sec) the experimental values again fall below the theoretical curve. When the end effect is taken into account, the boundary factor is shown to be in quantitative agreement with experiment. (P.C.H.)

9144 INELASTIC ENERGY LOSS IN COLLISIONS OF ARGON WITH ARGON AT KILOVOLT ENERGIES. Gerry Harwick Morgan. Thesis, Storrs, Conn., Univ. of Connecticut, 1962. 79p.

Measurements were made of the inelastic loss in kinetic energy in collisions of singly-ionized argon with argon atoms at energies in the range of 3 to 100 kev, as a function of scattering angle and charge state of the scattered recoil particle. The energy loss increases regularly with charge state and increases in steps with angle and incident particle energy. The positions of the steps coincide if plotted against distance of closest approach, indicating a type of shell structure. Evidence is presented that the various charge states arise from different parts of an overall distribution in energy loss, and that there is a preference for loss of electrons in pairs during the collision. (Dissertation Abst., 23: No. 5, Nov. 1962)

9145 ELECTRON COLLISION CROSS SECTION FOR HELIUM. Hugh Albert Williamson. Thesis, Austin, Tex., Univ. of Texas, 1962. 68p.

The Exchange Distorted Born-Oppenheimer (EDBO) approximation and the method of partial cross sections were used to calculate the effective elastic collision cross section as a function of the energy of slow electrons incident on normal helium (1^1S) and to calculate the effective inelastic collision cross section as a function of the incident electron energy for the $1^1S - 2^3S$ transition. The EDBO approximation allows for distortion of the scattered electron wave by both exchange and potential interaction with the helium atom. Only S-wave scattering (scattering of an incident electron with an angular momentum quantum number of 0) is considered in the elastic scattering calculation, while both S-wave scattering and P-wave scattering (scattering of an electron with an angular momentum quantum number of 1) are considered in the inelastic scattering calculation. An open shell wave function is used to represent the helium atom in the 1^1S state. The integro-differential equation, which determines the elastic scattering, is solved by Hulthen's variational method, using two different trial functions to represent the distorted electron wave. The trial functions were chosen to satisfy certain boundary conditions, and each contained three variational parameters (one of which specified the phase shift of the distorted electron wave). The results compare favorably with experimental values and are slightly superior to earlier calculations, which have used the same approximations but simpler wave functions to represent the 1^1S state and the elastically scattered wave. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9146 COLLIMATOR FOR HIGH ENERGY RADIATION BEAMS. (to Aviation Electric Ltd.). British Patent 912,084. Dec. 5, 1962. Priority date Feb. 8, 1960, Canada.

The collimator has been designed for use in radiation treatment of living tissue. It is adjustable, of simple mechanical construction, and can supply the necessary variation in solid angle without undue distortion of the beam pattern on the target. (R.J.S.)

9147 IMPROVEMENTS IN AND RELATING TO ION SOURCES. Seigfried Klein (to Commissariat à l'Energie Atomique). British Patent 913,956. Dec. 28, 1962. Priority date Sept. 20, 1958, France.

An ion source is designed which is small, very efficient, and supplies a pulsed current of several tens of amperes of ionized particles or electrons. The ion source comprises a conductive-walled enclosure, a second insulating-walled enclosure connected between the first enclosure and a source of the gas to be ionized, a conductive element in the inlet and outlet of the second enclosure, an inductive winding around the second enclosure, a condenser and a spark gap in the circuit, a high-voltage source for charging the condenser, and an ion-extractor electrode inside the first enclosure. An embodiment of the ion source is described which gives a power of 40 Mw. (D.L.C.)

9148 THERMOELECTRIC ELEMENTS HAVING GRADED ENERGY GAP. Fred D. Rosi (to Radio Corp. of America). U. S. Patent 3,050,574. Aug. 21, 1962.

The thermoelectric generator comprises two circuit members of thermoelectrically opposite semiconductor materials. The two members form a thermoelectric junction, at least one of the members having a varying composition such that its energy gap is graded from one end to the other. (R.J.S.)

9149 GUIDE FOR POLARIZED NEUTRONS. V. L. Sailor and R. W. Aichroth (to U. S. Atomic Energy Commission). U. S. Patent 3,067,365. Dec. 4, 1962.

The plane of polarization of a beam of polarized neutrons is changed by this invention, and the plane can be flipped back and forth quickly in two directions in a trouble-free manner. The invention comprises a guide having a plurality of oppositely directed magnets forming a gap for the neutron beam and the gaps are spaced longitudinally in a spiral along the beam at small stepped angles. When it is desired to flip the plane of polarization the magnets are suitably rotated to change the direction of the spiral of the gaps. (AEC)

9150 RADIOACTIVE BATTERY. Harry C. Lieb and Stanley Wallack (to Leesona Corp.). U. S. Patent 3,069,571. Dec. 18, 1962. Filed Dec. 16, 1957.

A device is described that directly utilizes the electrical energy emitted from a gaseous or fluid radioactive material by collecting emitted electrons. The device is designed to function under extreme conditions of temperature and/or shock. (R.J.S.)

9151 ELECTROSTATIC PROPULSION MEANS. William J. Coleman and Daniel F. De Santo (to Grumman Aircraft Engineering Corp.). U. S. Patent 3,071,705. Jan. 1, 1963. Filed Oct. 6, 1958.

Means are described for propelling air and other fluids by electrostatic forces, and for propelling devices through air and other fluids by such forces. (R.J.S.)

Astrophysics and Cosmology

9152 (NYO-10249) ON THE ENERGY DEPENDENCE OF FRAGMENTATION OF COSMIC RAY NUCLEI IN INTERSTELLAR SPACE. H. H. Aly and M. V. K. Appa Rao (Rochester, N. Y. Univ.). Nov. 2, 1962. Contract AT(30-1)-875. 19p.

The energy dependence of fragmentation probabilities for cosmic ray nuclei in interstellar H is investigated, using the data that exists from experiments in which protons of various energy bombard different nuclei. The probability of a medium nucleus (C,N,O,F) going into a light nucleus (Li,Be,B) in an interaction of a medium nucleus in H (P_{ML})seems to be energy independent up to energies of the order of 6 Bev per nucleon, whereas the probability of a heavy nucleus (Z > 10) going into a light nucleus (P_{HL}) seems to be strongly energy dependent. These results imply that the interstellar matter traversed by cosmic ray nuclei as deduced from the abundance of light nuclei is dependent on the energies under consideration. The maximum possible difference between the value deduced at low energy (~500 Mev/nucleon) and the value deduced at high energy (>1.5 Bev/nucleon) is about 2 gms/cm^2, if the experimentally measured ratio (Li,Be,B)/(C,N,O,F) is the same at the two energy ranges, the value at lower energies being higher. (auth)

9153 CONTINUUM ELECTROMAGNETIC RADIATION FROM SOLAR FLARES. W. A. Stein and E. P. Ney (Univ. of Minnesota, Minneapolis). J. Geophys. Res., 68: 65-81(Jan. 1, 1963).

Continuum electromagnetic radiation from solar flares is discussed in terms of the energy loss processes of electrons in the solar atmosphere. It is shown that it is possible to attribute the continuum radiation both at radio frequencies and at visible frequencies to synchrotron radiation by exponential rigidity distributions of electrons. (auth)

9154 PLASMA INSTABILITY AND THE MICROWAVE RADIATION FROM VENUS. F. L. Scarf (Space Tech. Labs., Redondo Beach, Calif.). J. Geophys. Res., 68: 141-6(Jan. 1, 1963).

It is assumed that the magnetic field of Venus is sufficiently small so that part of the solar wind penetrates to the ionosphere, and the wind-ionosphere interaction is examined. The two-stream plasma instability naturally leads to growing density striations with wavelengths of the order of 1 to 10 cm, and these patterns must ultimately break up and radiate strongly. If the radiation intensity is peaked at the high harmonics of the plasma frequency associated with the characteristic wavelength of the instability, this interaction may account for the high microwave brightness temperatures. (auth)

9155 FINITE UNIVERSE AND MACH'S PRINCIPLE. H. Dehnen and H. Hoenl (Universität, Freiburg i. B.). Nature, 196: 362-3(Oct. 27, 1962).

9156 LABORATORY TEST OF THE FINLAY-FREUNDLICH RED SHIFT HYPOTHESIS. R. A. Alpher (General Electric Research Lab., Schenectady, N. Y.). Nature, 196: 367-8(Oct. 27, 1962).

The Finlay-Freundlich hypothesis is based on anomalies in various stellar red shifts and suggests that these, as well as the Hubble-Humason red shift in galactic spectra, commonly interpreted as Doppler shifts in an expanding universe, are in fact the result of loss of energy by observed photons traversing a radiation field. An experiment is suggested in which an optical maser is used to provide a radiation field through which to pass the photons the wavelengths of which are to be observed. (L.T.W.)

9157 MEASUREMENT OF MAGNETIC FIELDS IN INTERSTELLAR CLOUDS. R. D. Davies, G. L. Verschuur, and P. A. T. Wild (Univ. of Manchester, Eng.). Nature, 196: 563(Nov. 10, 1962).

A new and successful attempt to measure magnetic fields in the Milky Way using the 250-ft radio telescope at Jodrell Bank is reported. The measurements were made by observing the Zeeman splitting of the neutral hydrogen line profiles. The strongest indication of Zeeman splitting was shown by the narrow deep feature of Taurus A. This feature has been shown to be double and has been resolved into two absorbing clouds, one having a magnetic field of 2.5×10^{-5} gauss and the other a magnetic field of 5×10^{-6} gauss. Similar but weaker Zeeman features were found in the absorption spectra of Cassiopeia A and Cygnus A. The maximum components of the magnetic field seen in the clouds of the Cassiopeia A and Cygnus A directions are about 5×10^{-6} gauss. Therefore, these results suggest that the general galactic magnetic field is of the order of 5×10^{-6} gauss. (L.T.W.)

9158 NEUTRON-CAPTURING PROCESSES IN STARS. H. L. Duorah and R. S. Kushwaha (Univ. of Delhi). Phys. Letters, 2: 55-6(Aug. 1, 1962). (In English)

The cross sections for neutron absorption by N^{14}, O^{17}, and Ne^{21} are given for 10, 15, and 60 kev neutron energies, and the products of the abundances expected in stellar interiors and the capture cross sections for 15 kev neutrons are listed. At low temperatures in stellar interiors the neutron capture process, starting with Ne^{20} as seed nucleus, is discussed and seen to progress in a cycle through Ne^{21}, O^{18}, O^{19}, F^{19}, F^{20}, back to Ne^{20}. This cyclic reaction is seen to establish a definite dynamic equilibrium between the species of atomic nuclei involved in the cycle. Abundance ratios of Ne^{20}/Ne^{21} and O^{18}/F^{19} are calculated and compared with observed ratios. Some possible neutron and heavy seed nuclei production processes are discussed. (H.D.R.)

9159 HELIUM BURNING REACTIONS IN STARS. Hira Lal Duorah (Univ. of Delhi). Progr. Theoret. Phys. (Kyoto), 28: 585-8(Oct. 1962). (In English)

Helium burning reaction rates are calculated with experimental information at temperatures in the ranges 1 to 2×10^8 and 3 to 6×10^8 °K. A fresh supply of helium at the higher range of temperatures may come from certain heavy-ion reactions. At lower temperature ranges Ne^{20} production rate is found to be too slow. (auth)

9160 MARINER II: HIGH-ENERGY-RADIATION EXPERIMENT. Hugh R. Anderson (California Inst. of Tech., Pasadena). Science, 139: 42-5(Jan. 4, 1963).

The radiation experiment on Mariner II was undertaken to investigate the dependence of the intensity of ionizing radiation in space upon distance from the sun; temporal variations of the radiation and their correlation with measurements of the magnetic field and plasma flux at the location of the spacecraft, and with solar-terrestrial disturbances; and the intensity and extent of magnetically trapped radiation, if any, around Venus. Results are briefly discussed. (R.J.S.)

9161 FORMATION OF STARS IN THE EXPANDING UNIVERSE. Ya. B. Zel'dovich. Zh. Eksperim. i Teoret. Fiz., 43: 1982-4(Nov. 1962). (In Russian)

In attempting to answer the question how the originally uniform matter of the expanding universe was broken up to form stars and galaxies, the solid–gas phase transformation must be taken into consideration. E. Lifshits found that small density perturbations grow proportionally with the radius of the universe. Assuming that the sun and galaxy contain about 10^{57} and 10^{68} nucleons, respectively, the probability of density fluctuations at the start was calculated to be $\delta\rho/\rho = 1/\sqrt{N}$ or 3×10^{-29} and 10^{-34}, respectively. These fluctuations are extremely small. Gamov, Alpher, and Herman took the effect of extremely high temperatures into consideration, concluding that no phase transformation can occur during the expansion. It was assumed that the phase transformations are the cause of the large amplitude of the initial perturbations if the material is at a substellar state in the form of protons, electrons, and neutrinos. Calculations indicated a gradual increase of the tension during expansion, terminated by a universal breakup at 3260 sec. At the location of such a breakup an acoustic wave is sent out, releasing the tension in neighboring areas. The solid hydrogen mass is broken up in 100 km long pieces, with masses of about 10^{20} g. For the sun, if the fluctuation occured at $\rho_0 = 0.01$, a $\rho_1 = 1$ can be obtained in 3×10^5 years. The proposed mechanism is not able to explain the formation of galaxies but it may be assumed that the formation of stars and the nuclear reactions taking place in them create perturbations which are added to the gravitational instabilities. (TTT)

Cosmic Radiation

9162 (AFCRL-62-260) ATMOSPHERIC DEPTH AND EFFECTIVE SOLID ANGLE FOR RADIATION PENETRATING THE ATMOSPHERE. Geophysical Research Papers No. 74. John T. A. Ely (Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.). Feb. 1962. 71p. (AD-275125)

Derivations and numerical evaluation of theoretical expressions for atmospheric depth, or air mass, and effective solid angle are presented. Calculations were performed on an IBM 709 computer. Atmospheric depth, expressed as mass per unit area, is the line integral of atmospheric density along a ray path. The rays are classified according to height of the terminus and zenith angle. The density data of the ARDC Model Atmosphere, 1959, were used in the calculation. Effective solid angle, at a given altitude for a given type of radiation, is that number which, multiplied by the initial isotropic flux outside the atmosphere, gives the observed omnidirectional flux (flux integrated over solid angle). Effective solid angles are calculated for two modes of attenuation. The first mode applies to the cases in which only nuclear collisions are important. The second mode takes into account both nuclear collisions and ionization loss. (auth)

9163 (AFCRL-62-484) INTERPLANETARY IONIZATION BY SOLAR EXTREME ULTRAVIOLET RADIATION. Guenter Loeser Memorial Lecture. Hans H. Hinteregger (Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.). 1960. 19p. (AD-277383)

From recent rocket monochromator measurements of solar photon fluxes $\Phi(\lambda)$ between 1300 and 60 A around 200 km, the fluxes Φ_0 characteristic of the upper F_2 region and interplanetary space near the earth are estimated by assuming some reasonable spectral attenuation factors Φ/Φ_0 because of the atmospheric absorption above the point of observation. Ionization rates in terms of $\sigma_j \Phi_0$ are estimated for H, O, N, and N_2. The estimated total ionization rate for the hydrogen atom of about 5×10^{-7} per sec implies a fractional ionization of at least 99.9% for total hydrogen particle number densities of less than about 500 per cc. (auth)

9164 (AFOSR-419) FINAL REPORT [ON COSMIC RAYS], JULY 1, 1960 TO SEPTEMBER 30, 1962. R. R. Brown (California. Univ., Berkeley). Nov. 1962. Contract AF49(638)-873. 7p. (AD-291157)

Activities in a program directed toward exploring radiation effects at balloon altitudes in the auroral zones are reported. It is noted that this location offers the best opportunity for obtaining information on particle bombardment of the atmosphere resulting from solar activity. A summary of progress in the experimental and theoretical programs is given, and plans for future work are discussed. (J.R.D.)

9165 (BNL-5909) CONSTANCY OF COSMIC RAYS IN TIME. D. Haymann and O. A. Schaeffer (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT(30-2)-Gen-16]. 14p.

The relative production of Ar^{39}/Cl^{36} in iron by 6.2 Bev protons has been measured to be 0.96 ± 0.05. This ratio is compared to the Ar^{39}/Cl^{36} ratio of 0.98 ± 0.05 found in iron meteorites whose date of fall to the earth is known. It is concluded that the ratio of the average cosmic ray intensity during the last 300 years has been 1.02 ± 0.07 times the average cosmic ray intensity during the last 300,000 years. In this sense, cosmic ray intensity has been essentially unchanged. (auth)

9166 (JINR-P-1112) UGLOVOE I ENERGETICHESKOE RASPREDELENIE BYSTRYKH μ-MEZONOV PRONIKSHIKH IZ ATMOSFERY NA BOL'SHUYU GLUBINU V ZEMLYU. (Angular and Energy Distribution of Fast μ-Mesons Penetrating Deep into the Earth from Atmosphere). L. G. Zastavenko and A. Chilok (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). Oct. 24, 1962. 8p.

The angular and energy distributions of μ mesons penetrating deep into the Earth from above (the depth is 4×10^4 g/cm^2) in the angle region $\cos\theta < -0.4$ ($\cos\theta = 1$ corresponds to the downward direction) and in the energy range $E > 0.75$ Bev were calculated. (auth)

9167 (N62-10690) ON THE EFFECT OF GEOMAGNETIC FLUCTUATIONS ON TRAPPED PARTICLES. Leverett Davis, Jr. and David B. Chang (California Inst. of Tech., Pasadena). [1962]. 26p.

The effect of large-scale geomagnetic fluctuations on Van Allen belt particles with mirror points near the geomagnetic equatorial plane is studied in a model where a dipole field is perturbed by the sudden approach and adiabatic withdrawal of a perfectly conducting plane. The Fokker-Planck equation for the particle density is obtained by following the motions of the particle guiding centers, assuming that the first and second adiabatic invariants, but not the third, remain valid during the approach. Steady state and transient solutions for several cases are obtained. The steady state solution for the density of particles with a particular non-relativistic energy, E, due to a source producing the density $KE^{-(s+1)}$ at an intermediate radius with sinks at very large and very small radii, varies with radius, r, approximately as r^{-4-3s} inside the source region and as r^{-11-3s} outside it. The equations resemble, but are not identical with those of Parker [1960]

for the same problem, corresponding solutions differing in that his density at small radii is less. (auth)

9168 (N62-12904) AN INTERIM INTERSTELLAR RADIATION FIELD. Theodore P. Stecher and James E. Milligan (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.). [1961]. 5p.

Modifications of the form of the interstellar radiation field, based on stellar spectrophotometric and photometric observations, are discussed. Total energy density in the λ 0 to 8000 region is reduced from 3.3×10^{-13} erg cm^{-3} to 2.0×10^{-13} erg cm^{-3} in the modified field. Lessened ionization for elements with ionization cross section from 5 to 13 ev results from the reduced intensity. (D.C.W.)

9169 (SUI-62-1) TIME VARIATIONS OF INTENSITY IN THE EARTH'S INNER RADIATION ZONE—OCTOBER 1959–DECEMBER 1960 (thesis). Guido Pizzella (Iowa. State Univ., Iowa City. Graduate Coll.). Feb. 1962. Contracts N9onr-93803 and NASw-17. 61p. (N62-10054)

The Geiger tube used, considerations involved in the gathering of data, analysis of the data, and conclusions drawn are aspects of the first long-term study of time variations in the lower portion of the inner Van Allen Belt discussed. Correlation of time variations in discrete steps with major solar proton events and/or major geomagnetic storms is indicated. Time variations of almost a factor of three occur, and one significant change occurred within a period of less than two weeks. A strong impulsive source of the trapped particles throughout the zone is concluded to exist and to be of more quantitative importance than the neutron albedo decay products of the galactic cosmic radiation. Counting rate graphs are included. 38 references. (D.C.W.)

9170 (TID-16951) THE RELATION BETWEEN COSMIC X-RAYS AND GAMMA RAYS. George W. Clark (Massachusetts Inst. of Tech., Cambridge). [1962]. Contract [AT(30-1)-2098]. 9p.

It is noted that recent efforts to measure the directional intensities of cosmic gamma rays above 10^{14} ev and cosmic x rays with wave lengths near 3 Å open a new approach to the study of several important astrophysical problems. This approach is based on the fact that 10^{14} ev electrons emit 3 Å x rays in the galactic magnetic field, and such electrons are secondary products of the same interstellar nuclear interactions as are the 10^{14} ev gamma rays. A discussion of findings concerning the origin of 10^{14} ev gamma rays is presented. (J.R.D.)

9171 (UCRL-6902-T) THE ELECTRON SPECTRUM FROM 90 TO 1200 kev AS OBSERVED ON DISCOVERER SATELLITES 29 AND 31. L. G. Mann, S. D. Bloom, and H. I. West, Jr. (California. Univ., Livermore. Lawrence Radiation Lab.). [1962]. Contract [W-7405-Eng-48]. 29p.

The electron spectrum was measured in nearly polar orbits on Discoverers 29 and 31 with a 10-channel electron spectrometer looking outward along the radius vector of the earth. At the present state of data analysis, three types of spectra can be clearly distinguished and are designated as A, B, and C for low, intermediate, and high-energy spectra: Type A spectra were observed in Channel 1 only. If the change in spectral shape over the energy range of Channel 1 (effectively 28 kev) is ignored, then the measured fluxes (for Channel 1) were often greater than 1.5×10^5 electrons/cm^2-sec-sr-kev, the saturation point of the circuitry. Type A spectra were observed almost exclusively on Flight 29 and were time dependent. Also they were observed principally in the Northern Hemisphere at altitudes of 160 to 200 km. A magnetic storm which occurred during this flight may have had strong effects on this type of flux. Type B spectra were observed in the first three low-energy channels of the spectrometer and have a spectral shape of the form $N_0 e^{-E/b}$ in which b has two predominant values, 25 ± 5 kev and 42 ± 3 kev. N_0 is typically of the order of 5×10^4 electrons/cm^2-sec-sr-kev. These data were taken mainly in the southern auroral zone at an altitude of the order of 560 km and occurred in the form of jets or sharp rises in counting rate, frequently going from zero to full value in less than 50 km. Numerical comparison of the observations of this phenomenon with similar observations made by F. Seward with his CsI scintillator (which was aboard both flights) indicates that the angular divergence of the jets is less than the resolution of our spectrometer. B spectra were observed at angles of 10 to 20° with respect to the field lines. The C spectrum was observed in the region of the South American dipolar anomaly at altitudes of ≲560 km. At low energies, the spectral shape was similar to the B spectra. At higher energies (>200 kev), the spectrum exhibits a shape much as expected from a neutron albedo source with a broad maximum ranging from 600 kev to 1000 kev. The maximum flux at 1000 kev was ≈480 electrons/cm^2-sec-sr-kev. There were no sharp changes in the spectrum with spatial position as observed with B spectra, but rather the counting rate changed smoothly as the spectrometer passed through the anomaly. The spectrometer passed through the anomaly about 30 times during the course of the flights and showed count rate differences as might be expected due to sampling the inner belt at different places with little evidence of temporal changes. (auth)

9172 HIGH-ENERGY ELECTRONS IN THE RADIATION BELT. M. P. Nakada (National Aeronautics and Space Administration, Greenbelt, Md.). J. Geophys. Res., 68: 47-53(Jan. 1, 1963).

The birth spectrums of high-energy electrons from the decay of energetic neutrons from cosmic ray albedo have been calculated. Assuming that energy loss is the principle loss mechanism for these energetic electrons, an equilibrium flux of electrons has been derived. (auth)

9173 PROTONS IN THE OUTER ZONE OF THE RADIATION BELT. S. J. Bame (Los Alamos Scientific Lab., N. Mex.), J. P. Conner, H. H. Hill, and F. E. Holly. J. Geophys. Res., 68: 55-63(Jan. 1, 1963). (LADC-5093)

The trapped protons in the outer zone of the Van Allen radiation belt were measured on October 4, 1960, by means of a Scout rocket payload containing a two-crystal scintillation spectrometer. Protons with energies above 1 Mev were detected, the intensity rising above background at an altitude of 1200 km. Representative intensities for $1 \leq E_p \leq 80$ Mev at 2, 3, 4, and 5×10^3 km, through a range of 42°N to 30°N geomagnetic latitudes, were 0.27, 0.90, 2.02, and 4.56×10^5 protons/cm^2 sec ster. These intensities are averages for protons having pitch angles between 90° and ~60°. The proton energy spectrum at 5000 km is $J(E) = 2.0 \times 10^6 E^{-5.2}$ protons/cm^2 sec ster Mev for $1.02 \leq E_p \leq 2.24$ Mev, and $J(E) = 0.71 \times 10^6 E^{-3.9}$ for $2.24 \leq E_p \leq 7.3$ Mev. The pitch angle distributions for altitudes of 4600 km and 5150 km were also obtained for angles between 90° and 58°. There was no evidence for a proton intensity maximum coincident with the E_2 maximum. (auth)

9174 EFFECTS OF COSMIC RADIATION ON THE EXTREMELY LOW-FREQUENCY PROPERTIES OF THE MESOSPHERE. Philip A. Goldberg (Rand Corp., Santa Monica, Calif.). J. Geophys. Res., 68: 101-10(Jan. 1, 1963).

At extremely low frequencies (1 to 3000 cps), relatively slight amounts of ionization can produce notable effects on electromagnetic phenomena in the terrestrial system.

Representative atmospheric conditions are examined to find minimum conditions that can produce such strong ELF effects at geophysically quiet periods. On the basis of analyses of ion production parameters, it is found that even for quiet nights, when only cosmic radiation is important for producing ionization in the mesosphere, large refractivities can be produced in this portion of the atmosphere below the ionosphere. For even a minimum electron detachment condition the refractive index of the mesosphere has the large magnitude of 4 at an altitude 75 km. For a more inclusive ion production condition with a maximum detachment factor that collates with VLF observations, strong refractivity effects occur at quite low altitudes: 35 km at 1 cps, 50 km at 10 cps, 55 km at 100 cps, and 65 km at 1000 cps. At very low frequencies (10 kc/s and above) effective altitudes for the nighttime lower ionosphere take on values normally assumed. During daytime and active solar periods it is indicated that strong refractivity effects will occur at altitudes below 30 km. (auth)

9175 ASYMPTOTIC CONES OF ACCEPTANCE AND THEIR USE IN THE STUDY OF THE DAILY VARIATION OF COSMIC RADIATION. U. R. Rao (Massachusetts Inst. of Tech., Cambridge), K. G. McCracken, and D. Venkatesan. J. Geophys. Res., 68: 345-69(Jan.15, 1963).

The dependence of the counting rate of a cosmic ray detector on the asymptotic directions of approach of the primary cosmic radiation is discussed. By means of a simulation of the geomagnetic field that uses spherical harmonics up to the sixth degree, and an arbitrary anisotropy in the primary cosmic radiation a method for calculating the time variations in the counting rate of a cosmic ray detector is developed. Resolving the arbitrary anisotropy as a Fourier series in longitude, the amplitude and phases of the diurnal (24-hourly) and semi-diurnal (12-hourly) components of the daily variation are calculated for a number of stations. No simple relationship is observed between the phases and the latitudes and longitudes, geographic or geomagnetic. Moreover, the theoretical calculations point out that a difference of more than five hours between the diurnal phases at two different places could arise purely from the known geomagnetic configuration. A study of the time-averaged diurnal component of the daily variation experimentally observed by 22 neutron monitors during the International Geophysical Year (1957-1958) reveals good agreement with the theoretical calculations and leads to the following conclusions: (1) The results are consistent with an anisotropy that is independent of rigidity in the range 1–200 bv, the exponent of the power law which fits the data being 0.0 ± 0.05. (2) The anisotropy varies as the cosine of the asymptotic latitude and has a maximum in the direction 85° to the east of the earth-sun line. (3) The maximum amplitude of the average anisotropy is 4×10^{-3} times the average cosmic ray flux. (auth)

9176 EVIDENCE FOR X-RAYS FROM SOURCES OUTSIDE THE SOLAR SYSTEM. Riccardo Giacconi (American Science and Engineering, Inc., Cambridge, Mass.), Herbert Gursky, Frank R. Paolini, and Bruno B. Rossi. Phys. Rev. Letters, 9: 439-43(Dec. 1, 1962).

Data from an Aerobee rocket carrying three large-area geiger counters have revealed a considerable flux of radiation in the night sky. Analysis of these data indicates the bulk of the radiation is soft x rays from sources outside the solar system. Synchrotron radiation by cosmic electrons is a possible mechanism for the production of these x rays. Ordinary stellar sources could also contribute a considerable fraction of the observed radiation. (H.D.R.)

9177 THE PRODUCTION OF RADIOISOTOPES IN COLLISIONS OF COSMIC RAY NUCLEI WITH HYDROGEN IN SPACE AND THE EFFECT OF THEIR DECAY ON THE COMPOSITION OF THE RADIATION OBSERVED NEAR THE EARTH. G. D. Badhwar, R. R. Daniel, and B. Vijayalakshmi (Tata Inst. of Fundamental Research, Bombay). Progr. Theoret. Phys. (Kyoto), 28: 607-23 (Oct. 1962). (In English)

The effects arising from the decay of radioisotopes produced in collisions of cosmic-ray nuclei with hydrogen in space on the composition of the radiation observed in the neighborhood of the earth are investigated. The production cross sections for all the individual isotopes resulting from such collisions are deduced, using experimental data and an empirical relation. The calculations show that: the cosmic radiation should traverse an amount of 2.5 ± 0.5 g/cm^2 of hydrogen between the source region and the earth; the calculated relative intensities of Li, Be, and B nuclei, produced in collisions of heavy nuclei with hydrogen, after taking decay effects into account, agree with the observed relative intensities of these nuclei in the primary cosmic radiation in the vicinity of the earth; nuclei with Z = 16 to 19 are very rare near the source region compared to nuclei with Z = 10 to 15 and Z = 20 to 28; the decay effects of radioisotopes give rise to pronounced even-odd effects for nuclei with Z = 10 to 19; and with experimental data on the composition of the primary cosmic radiation at the top of the earth's atmosphere and the partial cross sections deduced, it is impossible to start with a pure Fe-source for the cosmic radiation and obtain the observed chemical composition near the earth by spallation processes. (auth)

9178 A MONTE-CARLO STUDY OF THE TWO-CENTRE MODEL OF COSMIC-RAY JETS. S. Alper (Electrotechnical Research Inst., Bucharest) and E. M. Friedlaender. Rev. Phys., Acad. rep. populaire Roumaine, 7: 311-23(1962). (In English)

In studies of meson jets produced in the collisions of very high-energy nucleons, transformations from the laboratory system to the c.m.s. and/or to the rest systems of the fireballs have been performed under the arbitrary assumption that the velocity β' of each secondary in the c.m.s. is equal to the relative velocity β_c of the c.m.s. and of the laboratory system. It is shown that this assumption is false, and an investigation was made on the effects of $\beta' \neq \beta_c$ on the parameters derived from experimental data. A Monte Carlo procedure was used to construct artificial jets, which were then treated assuming $\beta' = \beta_c$. It was found that the Castagnoli formula overestimates the true angular distribution γ_c value by ~33%, and that the laboratory system dispersion of lg tg θ is underestimated by ~12%, whereas the differential lg tg θ plots and Duller-Walker diagrams are relatively unaffected. The use of the maximum jet angle for deriving the inelasticity or related quantities involves serious errors (overestimation by ~50%). The lg tg θ dispersions in the individual cones are also underestimated, and it is suggested that the actual angular distribution in the fireball rest systems is not isotropic. (D.L.C.)

9179 EXPERIMENTAL OBSERVATIONS OF THE EARTH'S TRAPPED RADIATION DURING AUGUST AND SEPTEMBER, 1959. Robert Adolph Hoffman. Thesis, Minneapolis, Univ. of Minnesota, 1962. 205p.

An analysis was made of data received between August 7 and October 2, 1959, from the Geiger counter and ionization chamber aboard the U. S. earth satellite Explorer VI, while the satellite was passing through the two great radiation belts surrounding the earth. A differential energy

spectrum of an assumed power law form for trapped protons was fitted to data received from 12 passes through the inner belt. Above an energy of 30 Mev, the spectrum has the form of $E^{-1.65}$ at about −28° geomagnetic latitude. The spectrum was checked by comparison of the actual proton counting rate of the triple coincidence telescope aboard Explorer VI in the inner belt with the rate calculated from such a spectrum. It is then shown that the counting rate from the scintillation counter aboard Explorer VI is probably due primarily to electrons. Electron fluxes at the maximum of the inner belt are given as about 2×10^9 electrons/cm^2 · sec from 200 to 500 kev, or about 1×10^7 electrons/cm^2 · sec greater than 500 kev at −28° geomagnetic latitude. The spectra obtained are shown to be in agreement with those previously published, and not in conflict with that calculated from neutron albedo decay. The data also place an upper limit of about 10% for time variations caused by magnetic storms, although they are probably consistent with no variations at all. Because of the high ellipticity of the orbit and because with respect to the geomagnetic axis of the earth the orbits swing northward and southward in latitude, a large part of the outer belt was swept out in a period of several days. Three sets of contours of constant counting rates from the Geiger counter were constructed for three periods of time, which show the large variability in intensity, volume, and structure of the outer belt due to magnetic activity. The observations by the detectors aboard this satellite of two maxima in counting rate in the outer belt had created some discussion by workers in the field However, it is shown that the relative minimum between is not caused by the Capetown magnetic anomaly in the earth's field, as was suggested, nor by any other earth surface or atmospheric effect. The alternative explanation appears to be a spectrum of trapped electrons varying with range that is measured by detectors having peculiar efficiency characteristics such that the minimum is only a detector effect. A theory for obtaining equatorial pitch angle distributions of the trapped particles from a counting rate of a detector down a magnetic line of force is presented and applied to the outer belt electrons The distributions obtained seem to exclude the possibility of an important contribution to the fluxes observed by the detectors due to electrons from the decay of albedo neutrons. Correlations between solar observations, radiation detector counting rates, magnetic storms, Forbush decreases, and satellite magnetometer measurements were studied Major intensity changes always correlated with solar activity, and time delays indicated the coupling was by means of solar plasma beams. Time intensity variations of the trapped radiation showed a radial dependence during magnetic activity; the larger the distance, the larger the variations and less correlation with earth surface magnetometer changes. Counting rates near the equator decreased for all radial distances if a magnetic storm included a main phase. Counting rate increases occurred during the recovery phase of magnetic storms, and were apparently due to a local acceleration mechanism. Finally several dumping and acceleration mechanisms are discussed in light of the observations of counting rate variations and magnetic field deformations during magnetic storms. (Dissertation Abstr., 23: No. 5, Nov. 1962)

Criticality Studies

9180 ESTIMATION OF THE BUCKLING OF ^{239}Pu FUELED SYSTEM FROM THE DATA OF COMPOSITE ^{239}Pu–^{235}U FUELED FAST CRITICAL ASSEMBLY. Hiroshi Ishikawa (Japan Atomic Energy Research Inst., Tokyo). Nippon Genshiryoku Gakkaishi, 4: 746-53(Nov. 1962). (In English)

Pu^{239}–U^{235}-fueled fast critical assemblies are of interest for the estimation of properties of Pu^{239}-fueled assemblies because of safety considerations and/or limited plutonium availability. Numerical analysis for bare and reflected homogeneous cores and reflected Two-region cores are previously reported. It is concluded that the errors in the calculated critical size for a 5.0 vol % Pu^{239}-fueled system reduce by more than a factor of about 10 to 20, if an accurate experimental value of critical size of a critical assembly fueled by 0.5 vol % Pu^{239} and 4.5 vol % U^{235} is known. A general mathematical formula, which is useful to explain the above conclusions more clearly, is obtained for bare homogeneous mixtures using multigroup diffusion approximation. In order to predict the critical radius for the bare homogeneous Pu^{239} system to an accuracy of 1%, the errors for the experimental value of critical radius must be less than 0.1% for $V^{Pu}/V^{Fuel} = 0.05$ and 0.2% for $V^{Pu}/V^{Fuel} = 0.1$, where V^{Pu} and V^{Fuel} are the volume fractions of Pu^{239} and fuel (Pu^{239} + U^{235}) respectively. For the reflected Two-region cores, the experimental errors required for the above accuracy must be less than 0.5% for the ratio of central Pu^{239} core region volume to total core volume of 0.1. (auth)

Elementary Particles and Radiations

9181 (AD-275843) A THEORY OF THE ORIGIN OF MASS WITHIN A CONTROL MODEL OF THE ELEMENTARY PARTICLES. E. W. Bastin and A. Woodside (Cambridge Language Research Unit, Cambridge, England). Feb. 20, 1962. Contract AF61(052)-331. 11p. (AFOSR-2702)

That a new method for calculating elementary particle constants is needed because the current method is appropriate only when some constants, which will be called primary constants, are assumed to be known already is shown. An experimental computing method for deriving numbers that have the right logical form to be interpreted as the primary type of constant characteristic of elementary particles is described, and a summary of the theoretical status of the results obtained is given. (auth)

9182 (AFOSR-2871) MULTI-LEVEL AND MULTI-CHANNEL ANALYSIS OF ELASTIC SCATTERING. Technical Report No. 4. G. E. Mitchell (Florida State Univ., Tallahassee. Tandem Accelerator Lab.). May 1962. Contract AF49(638)-427. 19p. (AD-277282)

Various approximations for the collision matrix that are relevant for elastic scattering analysis are discussed. A brief discussion is given on qualitative and semiquantitative techniques. The 1 level, 1 channel, the 2 level, 1 channel, and n level, 1 channel approximations are derived. The 1 level, n channel problem is treated; it is shown that, with the addition of one parameter, ordinary phase shift analysis is applicable. The 2 level, 2 channel approximation is derived from two different approaches to illustrate the extension to more levels and channels. (auth)

9183 (ANL-6647) A TREATMENT OF SOME PERIODIC POTENTIAL PROBLEMS. Dan McColl and O. C. Simpson (Argonne National Lab., Ill.). Nov. 1962. Contract W-31-109-eng-38. 73p.

A method of treating periodic potential problems, which appears to offer some simplifications, is described. The

classical Kronig-Penny problem was treated as an introduction to the applications after which the method was used to obtain the band structure for the periodic potential, the "parabolic scallop potential," consisting of a linear chain of segments of vertical parabolas opening upwards. The general problem for the one-dimensional periodic potential with reflection symmetry was then treated and illustrated by application of the method to the linear chain of inverted parabolic segments. As a third example the band structure was obtained for the "hip-roof" potential. The three-dimensional problem is also discussed. (auth)

9184 (CNEN-160) ENERGY LOSS OF FAST ELECTRONS IN BUBBLE CHAMBER (SUPPORTED IN PART BY UNITED STATES AIR FORCE, RESEARCH AND DEVELOPMENT COMMAND, EUROPE). P. E. Argan, G. Bendiscioli, E. Picasso, G. Piragino (Genoa. Università, Istituto di Fisica; Italy. Istituto Nazionale di Fisica Nucleare, Genoa; and Italy. Istituto Nazionale di Fisica Nucleare, Turin), and A. Gigli (Parma, Italy. Università). Dec. 1962. 26p.

Measurements on the energy loss of fast electrons ($2 \leq E_0 \leq 30$ Mev) in an ethane-propane bubble chamber are discussed. A method is briefly described for transforming the observed number of bubbles per centimeter, Nb/cm, to the number of nuclei per centimeter, Ng/cm, formed at the instant in which the electron crosses the sensitive medium. The value Ng/cm is shown to be an increasing function of the electron energy with an increase of 14.0% for incident electron energies between 8 and 20 Mev. Such an increase is shown to be theoretically justifiable if it is accepted that the energy necessary for the formation of a bubble (~100 to ~1,000 ev) is dissipated in a volume of linear dimensions of the order of the critical radius (r_c = $\sim 10^{-6}$ cm) through a sufficiently large number of energy transfers, each of the order of magnitude of average ionizing potential for the sensitive medium. (auth)

9185 (JINR-D-1107) PHASE SHIFT ANALYSIS OF ELASTIC (pp)-SCATTERING AT 660 Mev. R. Ya. Zul'karneev and I. N. Silin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). Oct. 29, 1962. 9p.

The phase-shift analysis of 660-Mev elastic pp scattering was performed. One set of phase shifts was obtained in the interval $\bar{\chi}^2 \leq \chi^2 \leq 2\bar{\chi}^2$ and four sets were obtained in the interval $2\bar{\chi}^2 \leq \chi^2 \leq 3\bar{\chi}^2$. The curves, calculated on the basis of the most probable phase shift set, for the angular dependence of the values $\sigma(\theta)$, $P(\theta)$, $C_{nn}(\theta)$, $C_{kp}(\theta)$, $D(\theta)$, $R(\theta)$, and $A(\theta)$, are given. (auth)

9186 (JINR-E-1069) ON THE PRODUCTION OF "SOFT" π MESONS IN PION-NUCLEON AND NUCLEON-NUCLEON COLLISIONS. S. M. Bilenky and R. M. Ryndin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). Aug. 13, 1962. 6p.

It is shown that in the limiting case of production of "soft" π mesons ($k \to 0$, k is the four-momenta of the π meson being produced) in π-N and N-N collisions, the invariance under the time reversal leads to some consequences for observables which are independent of the dynamics. So, for example, the recoil nucleon polarization in the production of "soft" π^0 mesons in π-N collisions vanishes. (auth)

9187 (JINR-P-1026) REAKTSIYA $\pi^- + p \to \pi^+ + \pi^- + n$ PRI ENERGII 240 Mev I (π-π) VZAIMODEISTVIE. (The Reaction $\pi^- + p \to \pi^+ + \pi^- + n$ at 240 Mev and (π-π) Interactions). Yu. A. Batusov, S. A. Bunyatov, V. M. Sidorov, and V. A. Yarba (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 8p.

The mass spectrum of the $(\pi^+\pi^-)$ system in the energy region 280–350 Mev is studied. The spectrum is shifted with respect to the phase space volume in the direction of larger mass values. However, no anomalies of resonance character are found. Additional arguments are given in favor of the fact that the nonresonant meson interaction in the final state with isotopic spin $T_{\pi\pi} = 0$ is the reason for the appearance of the so-called "anomaly" in the reactions with slow pion production. (auth)

9188 (JINR-P-1076) ANALIZ UPRUGOGO p-p RASSEYANIYA V OBLASTI ENERGII 2-24 Bev. (Analysis of Elastic pp Scattering in the Energy Region 2-24 Bev). V. G. Grishin, E. N. Tzyganov, and A. A. Yuldashev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1962. 4p.

Experimental data on elastic pp scattering at 2 to 24 Bev are analyzed from the standpoint of the theory developed in papers of Lovelace, Gribov and Pomeranchuk, Domokos, and others. (auth)

9189 (JINR-P-1087) O VOSSTANOVLENII AMPLITUDY NN-RASSEYANIYA V SASTOYANIYAKH T = 0. (On the Reduction of NN-Scattering Amplitude to T = 0 State). B. M. Golovin, R. Ya. Zulkaneev, V. I. Nikanorov, and V. I. Satarov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). Sept. 12, 1962. 7p.

Equations coupling nucleon and deuteron spin states with N-N scattering amplitude coefficients were obtained in pulse approximation, and the data on deuteron and nucleon polarization in elastic n-d scattering were applied in reducing N-N scattering amplitudes to the T = 0 states. (R.V.J.)

9190 (JINR-P-1093) K_{e4}-RASPADY I IZOSKALYARNYI $\pi\pi$-PERENOS PRI MALOI ENERGII. (K_{e4}-Decays and Isoscalar $\pi\pi$-Resonance at Low Energy). B. A. Arbuzov, Van-hieu Nguyen, and R. N. Faustov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 5p.

The probabilities of K_{e4} decays are calculated. That the assumption about the existence of π-π resonance in a state with I = 0, l = 0 at 310 Mev leads to values of the decay probabilities that exceed the upper limit of the experimental data is shown. (auth)

9191 (JINR-P-1110) INFRAKRASNYE OSOBENNOSTI V ELEKTRON-PROTONNOM RASSEYANII. (Infra-red Singularities in Electron-Proton Scattering). L. D. Solov'ev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). Oct. 27, 1962. 5p.

The form of singularity of electron-proton scattering amplitude near the zero value of squared momentum transfer is found with the aid of a renormalization group. This singularity is a pole, multiplied by a phase factor that is a relativistic generalization of the Coulomb phase factor. A relativistic generalization of a Regge trajectory for hydrogen is also obtained. (auth)

9192 (LAMS-2795) ON THE COMPUTATION OF THE TRANSPORT OF RADIATION. Burton Wendroff (Los Alamos Scientific Lab., N. Mex.). Nov. 1962. Contract W-7405-eng-36. 74p.

Some problems associated with the numerical solution of the equations of radiation transport in compressible fluids are discussed. These problems are in the following areas: formulating the differential equations, handling the frequency dependence, and obtaining and solving the difference equations. Some specific computing procedures are given. (auth)

9193 (LNF-62/61) SOME CALCULATIONS CONCERNING THE MEASUREMENT OF THE POLARIZATION

OF μ-MESONS, USING MØLLER-SCATTERING IN THE MAGNETIZED IRON PLATES OF A SPARK CHAMBER. Note No. 151. M. Conte and E. Ganssauge (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). July 14, 1962. 21p.

Measurements were of the polarization of mesons(μ) by Møller scattering in magnetized iron plates of a spark chamber. Theory and numerical examples are given. The possibility of using cosmic rays for measuring meson(μ) polarization was verified. Measurements using a magnetic separator and using a double spark chamber are described. (M.C.G.)

9194 (NP-12384) A SYMMETRIC REPRESENTATION FOR 3-BODY PROBLEMS. Felix T. Smith (Stanford Research Inst., Menlo Park, Calif.). May 1, 1961. Contract NASW-80. 21p.

The possibility of constructing a symmetrical representation for 3-body problems was explored. Operators were derived from the generalized angular momentum tensor which is given by $\Lambda^2 = \frac{1}{2} \Sigma_{ij} (\Lambda_{ij})^2$. The operators are connected with the total ordinary orbital momentum L and with the symmetric tensor Σ. The connection between L and Σ is also called the togetherness tensor since it determines (along with L) the probability of a collision bringing the three particles together. A normalized center-of-mass coordinate system is used to show the interaction of three bodies because the kinetic energy is of diagonal form and because transformation to laboratory coordinates is linear. The eigenvalues and degeneracy of Λ^2 and L^2 are determined by the construction of a family of generalized spherical harmonics in the 6-dimensional center-of-mass space of the 3-body problem. (auth)

9195 (NP-12399) NEUTRON ACOUSTODYNAMICS. S. Yip, R. K. Osborn, and C. Kikuchi (Michigan. Univ., Ann Arbor). [1962]. 91p.

An essentially self-contained treatment of the theory of low-energy neutron scattering is given with emphasis on the extent to which symmetries and dynamics of the scattering system may influence neutron-nuclear collision processes. The general problem is formulated using the "Born Approximation" and Fermi pseudopotential, and calculations are made for two crystal models. The simpler Einstein crystal is found to be adequate in qualitatively explaining the measured scattering cross section. For problems sensitive to dynamical features of the scatterer, a more realistic crystal model is carefully derived, and the associated problem of normal mode analysis, with both standing and traveling waves, is discussed in detail. It is shown that the more elaborate model gives results useful in the interpretation of the experimental studies of lattice dynamics, particularly in the direct determination of dispersion relations and frequency distributions. In obtaining the various cross sections the concept of coherent scattering in contrast to that of interference scattering is clearly illustrated; suitable approximations and meaningful limiting cases are obtained. Incoherence resulting from isotopic mixture and nuclear spin is also discussed. It is shown that the results of a semiclassical treatment are readily interpretable and should be helpful in a general understanding of the interaction of low-energy neutrons with solids. (auth)

9196 (NP-12448) ELEMENTARY S-MATRIX THEORY. Lecture Given by C. Moeller at Universitetets Institut for Teoretisk Fysik and NORDITA Copenhagen. (Nordisk Institut for Teoretisk Atomfysik, Copenhagen). 1958/59. 130p.

Topics covered in lectures on the S-matrix theory include: stationary treatment of collisions between the particles, stationary treatment of collision processes for a general system, time-dependent treatment of collision processes, and multichannel processes. (M.C.G.)

9197 (NP-12449) DISPERSION RELATIONS. Lecture Given in the Spring of 1958 by A. Pais at Universitetets Institut for Teoretisk Fysik and NORDITA Copenhagen. Notes Prepared by V. Wataghin and H. Wilhelmsson. (Nordisk Institut for Teoretisk Atomfysik, Copenhagen). June 1959. 44p.

Examples of the consequences of the hypothesis of causality in classical physics are given. The reduction formula for the scattering matrix elements is derived, and the rigorous derivation of the dispersion relations for pion-nucleon scattering in the forward direction is carried out on the basis of the ideas of K. Symanzik and N. N. Bogoljubov. The method consists in deriving the dispersion relations for an auxiliary amplitude that has no singularity in the unphysical energy region; from these relations the analyticity properties of the retarded amplitude are deduced; the dispersion relations for the pion-nucleon scattering amplitude follow straightforwardly from these properties. Applications of the dispersion relations are mentioned, and comment is included on the unphysical region present in the case of non-forward scattering. (auth)

9198 (NP-12452) SELECTED TOPICS IN THE THEORY OF PARTICLES AND FIELDS. Lecture given by E. H. Wichmann at Universitetets Institut for Teoretisk Fysik and NORDITA Copenhagen. (Nordisk Institut for Teoretisk Atomfysik, Copenhagen). June 1962. 282p.

The theory of the Lorentz group and other symmetry groups of interest in Field Theory are discussed. Facts and definitions in the theory of matrices and groups are reviewed. Topics covered include: inhomogeneous Lorentz transformations, the Lorentz group and the rotation group, tensors and tensor fields in Lorentz space, Lie groups, transformations in quantum mechanics, systems of many identical non-interacting particles, description of particles of arbitrary spin, finite-dimensional representations of the homogeneous proper Lorentz group, and Dirac theory. (M.C.G.)

9199 (ORNL-TM-422) A MONTE CARLO CALCULATION OF THE THREE-DIMENSIONAL DEVELOPMENT OF HIGH-ENERGY ELECTRON-PHOTON CASCADE SHOWERS. C. D. Zerby and H. S. Moran (Oak Ridge National Lab., Tenn.). Dec. 3, 1962. Contract [W-7405-eng-26]. 26p.

A description is given of a general-purpose Monte Carlo program for study of the three-dimensional development of high-energy electron-photon cascade showers in a homogeneous medium. The results of several study calculations are compared with previous analytic work to demonstrate the accuracy of the calculation. Another comparison with an experiment which measured the spatial distribution of the energy deposition in Sn by 185-Mev electron-initiated showers shows a discrepancy between calculation and experiment. (auth)

9200 (PAN-342/VI) ASYMMETRY IN LOW MULTIPLICITY JETS OBSERVED IN NUCLEAR EMULSIONS AT SUPER-HIGH ENERGIES. Jerzy Gierula and Marian Miesowicz (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1962. 11p.

In the analysis of high-energy jets ($E_p \geq 10^{12}$ ev), several cases were found which show very small multiplicity, isotropic angular distribution in the symmetry system,

and an unusually high value of V_c if calculated from symmetry conditions. These events may be interpreted as isotropic emission of secondaries from one center moving in a center-of-mass system of colliding nucleons in the direction of the primary particle. (auth)

9201 (PAN-356/VII) FOUR PION WAVE FUNCTIONS. Marek Grynberg and Ziro Koba (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Aug. 1962. 38p.

Following the same procedure as in the case of three pions, a complete set of orthonormal wave functions may be developed for four free pions. These wave functions describe systems of pions, which satisfy the Bose statistics and possess definite values of the total energy, the total angular momentum, and the parity in the center-of-mass system in the nonrelativistic approximation, as well as a definite charge parity when the system is neutral. The procedure for constructing this set of wave functions is described in detail and their explicit expressions are given up to $\Lambda = 3$, and the number of these eigenstates are listed up to $\Lambda = 5$. (The "effective angular momentum" Λ is defined.) (auth)

9202 (PAN-359/VII) REMARKS ON THE DISPERSION-THEORETICAL APPROACH TO PION-NUCLEON DIFFRACTION SCATTERING. Andrzej Krzywicki and Jerzy Wrzecionko (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Sept. 1962. 12p.

The Amati et al. theory of diffraction scattering is examined in the Bev region. It is shown that neglecting t-dependence of imaginary parts of scattering amplitudes in the unphysical region ($t > 0$) and many-body intermediate states in t-channel, one gets either too small a height or too large a width for the calculated diffraction peak as compared with experimental data. (auth)

9203 (UCRL-10470) A STUDY OF THE REACTION $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ AT 310 AND 377 Mev (thesis). Barry C. Barish (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 20, 1962. Contract W-7405-eng-48. 65p.

Proton distributions for the reaction $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ are measured at incident-pion energies of 310 and 377 Mev. The protons from this reaction are identified in a scintillation counter telescope by a combination of dE/dx, range, and time-of-flight methods. At 310 Mev, selected proton energy intervals are taken at laboratory-system angles of 15 and 22.5 deg. At 377 Mev, distributions in energy from 60.5 to 163.5 Mev at angles from 10 deg to the kinematic limit are measured. The total cross sections obtained are: 0.14 ± 0.07 mb at 310 Mev, and 0.37 ± 0.03 mb at 377 Mev. These values are in good agreement with the theoretical predictions of a $\pi\pi$ interaction model by Schnitzer in which his parameters are chosen to fit the total cross section and the π^+ angular distribution in the reaction $\pi^- + p \rightarrow \pi^+ + \pi^- + n$. (32 references.) (auth)

9204 (UCRL-10530) STUDY OF PION-PION SCATTERING FROM THE REACTION $\pi^+ + p \rightarrow \pi^+ + \pi^+ + n$ AT 1.25 AND 1.75 Bev/c (thesis). Leonard B. Auerbach (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 31, 1962. Contract W-7405-eng-48. 74p.

The equipment and procedure used in measuring the distribution of energy and angle of recoil of neutrons from the reaction $\pi^+ + p \rightarrow \pi^+ + \pi^+ + n$ for incident pion momenta of 1.25 and 1.75 Bev/c are explained. Utilization of the plastic scintillator detectors is given particular attention. Data on the cross section for pion-pion scattering are presented and analyzed. (22 references.) (D.C.W.)

9205 (UCRL-10564) DIFFERENTIAL DISTRIBUTIONS OF NEUTRONS IN INELASTIC π^-p INTERACTIONS AT 374, 417, AND 454 Mev (thesis). Richard J. Kurz (California. Univ., Berkeley. Lawrence Radiation Lab.). Nov. 15, 1962. Contract W-7405-eng-48. 142p.

The inelastic interactions of negative π mesons with protons at 374, 417, and 454 Mev incident π kinetic energy are studied by measuring the differential distributions of final-state neutrons. The π source is an internal target of the Berkeley 184-inch synchrocyclotron. A magnetic beam-transport system momentum-analyzes and focuses the π beam at a liquid hydrogen target located in an adjacent shielded experimental area. The time-of-flight distribution of neutral particles is measured at various laboratory-system angles between 10 and 65 deg. Neutral particles are detected by observing the charged products of their interactions in plastic scintillator. The time-of-flight information is determined electronically by time-to-height conversion and pulse-height analysis. The time resolution of the total system is 1.0 nsec. Detected neutral particles accompanied by charged particles are separated by the electronic system from those not accompanied by charged particles. Analysis presuming the principal inelastic reactions to be $\pi^-p \rightarrow \pi^+\pi^-n$ and $\pi^-p \rightarrow \pi^0\pi^0n$ separates the time-of-flight spectra into gamma rays, neutrons from the reaction $\pi^-p \rightarrow \pi^0n$, and inelastic neutrons. Calculated values of the neutron-detection efficiency are used in the conversion of the neutron time-of-flight distribution to neutron differential distributions as a function of energy. A description of the neutron efficiency calculation is included. A definite deviation from the behavior expected on the basis of a statistical distribution or a simple peripheral collision model is observed in the distributions of the inelastic neutrons. The inelastic neutron differential distributions showed a strong preference for neutrons of low cm momentum. By integrating the differential distributions, the total cross sections for the two inelastic reactions listed above were obtained. The cross section for the $\pi^+\pi^-n$ channel was a rapidly rising function of incident π energy, whereas the cross section for the $\pi^0\pi^0n$ channel was essentially constant as a function of energy. In addition, the total cross section for the processes $\pi^-p \rightarrow$ neutrals was obtained along with tentative data on the angular distribution of the reaction $\pi^-p \rightarrow \pi^0n$. (46 references) (auth)

9206 RELATIVISTIC EQUATION OF MOTION FOR A CHARGED PARTICLE WITH SPIN AND MAGNETIC MOMENT. I. TRANSLATIONAL EQUATION OF MOTION. I. F. Farkas (Roland Eötvös Univ., Budapest). Acta Phys. Acad. Sci. Hung., 15: 131-60(1962). (In English)

Starting from the modified form of the energy-momentum tensor, the translational equation of motion is determined. The four-potential is expanded in terms of the powers of $1/c$. The self-force acting on the particle is calculated. The divergent terms in the equations of motion are eliminated by the introduction of a compensating auxiliary field. It is shown that similar results are obtained if field equations of higher order are used. The variation of the rest mass caused by the self-force is also given. (auth)

9207 RELATIVISTIC EQUATION OF MOTION FOR A CHARGED PARTICLE WITH SPIN AND MAGNETIC MOMENT. II. EQUATION OF MOTION OF SPIN. I. F. Farkas (Roland Eötvös Univ., Budapest). Acta Phys. Acad. Sci. Hung., 15: 161-70(1962). (In English)

The equation of motion of spin is determined from the modified energy-momentum tensor. With the aid of the four-potential the momentum arising from the self-field of the particle is calculated. The divergent terms of the equation can be eliminated by the use of a compensating auxiliary field. (auth)

9208 SOME LAWS OF THE PROPAGATION OF γ-RAYS ALONG THE BOUNDARY BETWEEN TWO MEDIA. B. P. Bulatov. At. Energ. (USSR), 13: 440-5(Nov. 1962). (In Russian)

The intensity of γ-radiation emitted in air at the surface of a medium by an isotropic source represents the sum of the primary radiation and of the radiation scattered in both the medium and in air. The laws governing this phenomenon were experimentally determined, making use of a previously described method of the author et al., (Atomnaya Energiya 5: 631(1958) No. 6; ibid. 7, 369(1959) No. 4). The counter used in the experiments had a uniform sensitivity toward γ-quanta with various energies. Co^{60}, Cs^{137}, and Cr^{51} sources with intensities ranging from 2 microcuries to 7.25 curies and scattering materials with low Z numbers, such as earth, concrete, carbon, and iron were used in these studies in energy range of $0.33 \leq E_\gamma \leq 1.25$ Mev. It was found that the scattered radiation is generated by the fundamental narrow beam of the primary radiation. The effective scattering surface lies at a distance r from the point of intersection of the scattering surface with the axis of symmetry of the beam, r = 10 h. The contribution to the total energy of the radiation scattered in the medium increases up to incident angles of 80 to 85° of the primary narrow beam, after which it decreases uniformly. At incident angles near 90° the anisotropy of the angular distribution increases suddenly and the direction of the emitted scattered radiation differs only slightly from that of the primary radiation. (TTT)

9209 DETERMINATION OF THE BACKGROUND WHILE MEASURING ACTIVITIES OF THE ORDER OF 10^{-11} TO 10^{-13} CURIE. V. V. Artem'ev. At. Energ. (USSR), 13: 479-80(Nov. 1962). (In Russian)

Activity measurements must be occasionally carried out in presence of a background radiation with a higher value than the radiation under study. Such cases are encountered in geological prospecting, biological and medical experiments with isotopes having half life periods longer than 10 years, requiring instruments with sensisitivities exceeding the 10^{-13} to 10^{-14} curie range. Measurement of activities from 10^{-11} to 10^{-13} curie with an error of less than 1% requires tens of hours during which the background may vary radically because of the variations of cosmic rays and solar flares. In radiochemical dating studies the background usually consists of a constant component due to natural radioactive materials such as K^{40}, and decay products of the U and Th series, and of a variable component primarily controlled by the cosmic radiation. Multiple scattering and absorption events cause a spreading of the spectral lines in neighboring portions of the spectrum of the background radiation; the changes in the second component may be determined by decomposing the count rate. The method was used successfully in mass determinations of C^{14} in geological and archeological samples. The C sample was used to prepare ethyl benzene in which scintillating compounds, such as 2,5 diphenyl oxazol and 1,4-[di-2,5 phenyl oxazolyl] benzene were dissolved, measuring the activity by means of a scintillation counter and a photomultiplier. (TTT)

9210 UNIVERSAL TABLES FOR CALCULATING THE ATTENUATION OF γ-RADIATION FILTERS. N. G. Gusev, V. P. Mashkovich, and B. V. Verbitskiĭ. At. Energ. (USSR), 13: 480-1(Nov. 1962). (In Russian)

In view of the absorption of the γ-radiation in container walls and in filters, it is often difficult to determine the characteristics of a given radiation prior to passage through an attenuating medium. For this reason tables were prepared for facilitating the calculation of attenuation during passage through various types and thicknesses of materials. Results of calculations for Pb, Fe, and Al filters are presented on the basis of the formula $K = e^{\mu d}/B$ in which μ designated the attenuation coefficient, d the thickness, and B the buildup factor. The data on the Al filters may be used for estimating attenuation of the radiation in glass by recalculating the data on the basis of the density. The calculated values were experimentally verified by using isotropic sources of various energies, such as Hg^{203}, Cs^{137}, Co^{60}, and Ra in equilibrium with its daughters, and varying the thicknesses of the filters. The experimental and theoretical data agree with each within 2 to 6%, lying within the limits of the experimental error. (TTT)

9211 SCIENTIFIC PAPERS AT THE XIIth MEETING OF THE SCIENTIFIC COUNCIL OF THE JOINT INSTITUTE FOR NUCLEAR INVESTIGATIONS. V. Biryukov. At. Energ. (USSR), 13: 494-7(Nov. 1962). (In Russian)

Reports of work carried out at the Joint Institute were presented at the meeting in May 1962 in Dubna. Among the many papers presented were the following: E. N. Kladnitskaya reported on work concerning the generation of λ hyperons and K^0 mesons in $\pi^- - p$ and $\pi^- - C$ interactions at 7 to 8 Bev, carried out on the synchrophasotron of the High Energy Laboratory. E. N. Tsyganov presented a paper on the high-energy elastic p-p scattering in the 2 to 24 Bev energy region. A cooperative work of the Institute with the Berlin, Budapest, and Peking laboratories, started 2 years ago for studying simultaneously by means of photoemulsions the inelastic interaction of π^- mesons with nucleons at about 7 Bev was reviewed by V. Petrzhilka. Yu. D. Prokoshkin discussed the β decay of π mesons ($\pi^+ \rightarrow \pi^0 + e^+ + \gamma$) which is of interest for weak interactions. Measurement of the probability of the $\mu^- + He^3 \rightarrow H^3 + \gamma$ process was described by R. M. Sulyaev; it was found to be $\lambda = (1.36 + 0.18)\ 10^3\ sec^{-1}$. F. L. Shapiro described the research work carried out at the Neutron Physics Institute which included the determination of the parameters of the Rh levels and spin measurements. Prizes awarded were also announced at the meeting. (TTT)

9212 CONCERNING A NON-RELATIVISTIC QUANTUM MECHANICS OF SPATIALLY EXTENDED ELEMENTARY PARTICLES. Erich Bagge (Universität Kiel). Atomkernenergie, 7: 427-38(Dec. 1962). (In German)

If in the Hamiltonian of a system of elementary particles $H(P_k, Q_k) - E$, the Heisenberg commutation relations for the canonical conjugated momenta P_k and the coordinates Q_k, $P_kQ_l - Q_lP_k = \hbar/i\ \partial_{kl}$, are fulfilled by the following operators: $P_k \rightarrow \hbar/i\ \partial/\partial q_k$ and $Q_k \rightarrow q_k + q_k^{(0)}$ then the wave functions $\psi(q_k)$ as solutions of the modified Schrödinger equation $\{H(\hbar/i\ \partial/\partial q_k, q_k + q_k^{(0)}) - E\}\ \psi(q_k) = 0$ describe the particles of the system as extended particles of the linear dimensions $|q_k^{(0)}|$. The complex constants $q_k^{(0)}$ are characteristic for the special particles and they are called minimal lengths. This result follows from a study of the behavior of the linear oscillator, for which $|q_k^{(0)}|^2$ plays the role of the minimal mean square coordinate. For the case of proton-proton-interaction it is shown that this new mode of description for pure coulomb forces between the particles is leading to significant deviations from the Rutherford-Mott-formula of scattering, and it can be seen that for a suitable choice of the $q_k^{(0)}$, at least for energies up to 1 Mev, the observed values for scattering can be represented to a certain degree by this theory. (auth)

9213 STIMULATED EMISSION OF BREMSSTRAHLUNG. D. Marcuse. Bell System Tech. J., 41: 1557-71 (Sept. 1962).

A formula for the probability of stimulated emission of bremsstrahlung is derived. It is shown that stimulated emission occurs if the incident electrons travel in a direction roughly parallel to the electric field vector of the wave stimulating the emission. Emission from free electrons is used in electron tube devices. It is shown that stimulated emission occurs in the elementary process of the encounter of one electron with one nucleus or ion. There is no need for a slow-wave structure or elaborate electron bunching and no need to consider phase relationships. (auth)

9214 STUDY OF THE SHOCK ELECTRONS PRODUCED IN NUCLEAR EMULSIONS BY PROTONS HAVING AN ENERGY OF 26 Bev. Ivan Batthyany, Elisa Silva de Stuardo, Tasi-Chü, and Brigitte Willot-Chemel (Laboratoire de Physique-Enseignement, Faculté des Sciences, Paris). Compt. Rend., 255: 1910-12(Oct. 15, 1962). (In French)

The proton energy, measured by means of the shock electrons, was 25.7 ± 1.0 Bev. The ratio of the number of grain bundles between the 26-Bev protons and the electrons with energies between 100 and 350 Mev is 0.964 ± 0.006. (tr-auth)

9215 ELASTIC PROTON-PROTON SCATTERING UNDER SMALL ANGLES AT 6.2-Bev ENERGY. A. I. Zlateva, P. K. Markov, A. T. Peeva, L. G. Kristov, and Kh. M. Chernev. Compt. Rend. Acad. Bulgare Sci., 14: 443-6(1961).

Elastic p-p scattering at 6.2 Bev under angles of 1.2°-11.5° in the center-of-mass system was studied using a photoemulsion chamber irradiated by the internal proton beam of a proton synchrotron. An irradiation geometry was used, in which the incident flux is perpendicular to the plane of the emulsion layers. This experimental arrangement permits the efficient recording of p-p scattering down to very small angles, and a reliable singling out of background events. In all, 141 cases of elastic p-p scattering were singled out. The results are compared with the differential section under zero angle, calculated by the optical theorem using the full section of p-p interaction. Conclusions on the presence of a real part in the scattering amplitude or on its dependence on the spin state will be possible only after the statistical basis is extended. (Referativnyy zhurnal, Fizika, No. 6, 1962.)

9216 ON THE $\pi^- + p \rightarrow n + e^+ + e^-$ REACTION. V. M. Arutyunyan and E. V. Chubaryan (Inst. of Physics, Academy of Sciences, Armenian SSR and Erivan State Univ., USSR). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.-Mat. Nauk, 15: 81-4(1962). (In Russian)

The $\pi^- + p \rightarrow n + e^+ + e^-$ reaction was studied under the assumption of resonance in the two meson system (dipions). In a manner similar to Chew and Low, the cross section of the reaction was described by the annihilation cross section, $\pi^- + \pi^+ \rightarrow e^- + e^+$. It is shown that the two-dimensional distribution of the cross section according to the $e^+ - e^-$ pair transmitted momentum and energy has a resonance corresponding to the π-π resonance. (R.V.J.)

9217 A SIMPLE FORMULA FOR MASS ABSORPTION COEFFICIENTS NEAR THE K ABSORPTION EDGE. J. R. Rhodes (Wantage Research Lab., Berks, Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 255-9(May 1962). (In English)

An empirical approximation of the x-ray mass absorption coefficients of all elements having $Z \leq 96$ is calculated for x-ray energies just above and just below the K absorption edge. The approximate calculations are compared with theoretical predictions. (T.F.H.)

9218 MODIFIED MANDELSTAM REPRESENTATION FOR HEAVY PARTICLES. Jamal N. Islam (Cambridge Univ., Eng.). J. Math. Phys. (N. Y., 3: 1098-1106(Nov.-Dec. 1962).

The fourth-order Feynman amplitude ceases to satisfy the Mandelstam representation when the external masses are sufficiently large. A representation that replaces the Mandelstam one is found for the cases where the four mass invariants are equal in pairs. The physical interpretation is discussed. (auth)

9219 AXIOMATIC PERTURBATION THEORY FOR RETARDED FUNCTIONS. H. M. Fried (Inst. for Advanced Study, Princeton, N. J.). J. Math. Phys. (N. Y.), 3: 1107-15(Nov.-Dec. 1962).

A construction of the retarded n-point functions of perturbation theory is given without the specifications of an interaction Lagrangian. An intermediate-state expansion of retarded functionals is employed to define a systematic set of equations representing approximations to the (integral) unitary conditions; the requirement of symmetry of the (n−1) retarded coordinates of an n-point retarded function enters in an essential way. The class of solutions to these equations contains the renormalized-perturbation-theory retarded functions corresponding to local renoramlizable Lagrangian interactions, as well as more singular functions corresponding to nonrenormalizable interactions; if the latter are excluded all the n-point functions may be successively determined to all orders in the renormalized coupling constants. The construction is explicitly performed for the first radiative corrections to the 2- and 3-point functions of a self-interacting neutral scalar boson field, yielding the finite renormalized results of perturbation theory. Similar but slightly singular results are quoted for the π-π scattering amplitude. (auth)

9220 A CRITERION FOR SINGULARITIES IN PERTURBATION THEORY. Francis R. Halpern (Univ. of California, San Diego). J. Math. Phys. (N. Y.), 3: 1130-4(Nov.-Dec. 1962).

A criterion is proposed to distinguish between the singular and nonsingular portions of the Landau surface on the physical sheet. The set of diagrams under consideration are those containing a single loop. A proof of the Mandelstam representation for the four-point function is given, based on this criterion. (auth)

9221 ON SPINORS IN n DIMENSIONS. Abraham Pais (Brookhaven National Lab., Upton N. Y.) J. Math. Phys. (N. Y.), 3: 1135-9(Nov.-Dec. 1962).

The matrix that enters in the charge conjugation transformation of spinors in 4-space is an invariant matrix and is skew-symmetric. It is shown that there exists such an invariant matrix C for any number of dimensions (independent of the number of time-like dimensions). Its symmetry properties depend on the dimension number n modulo 8. The C matrix can be used to construct, for n = 1, 2, 7, or 8 mod 8, an n-dimensional invariant bilinear in the components of a single n-dimensional spinor. Some examples are given for n = 2, 3, 7. A bilinear baryon invariant is formed for a theory with high symmetry. Its existence is closely related to the triality property of 8-space. (auth)

9222 INTEGRAL REPRESENTATIONS FOR PRODUCTION AMPLITUDES IN PERTURBATION THEORY. Noboru Nakanishi (Inst. for Advanced Study, Princeton, N. J.). J. Math. Phys. (N. Y.), 3: 1139-46(Nov.-Dec. 1962).

The integral representation for two-particle scattering is extended to the case of one-particle-production amplitudes. Five integral representations are found, whose

main parts consist of only six terms. Their support properties are investigated for the equal-mass case in every order of perturbation theory. It is shown that lowest-order graphs are by no means the representatives of analyticity in perturbation theory even in the equal-mass case. (auth)

9223 ELASTIC SCATTERING OF PIONS BY ALPHA-PARTICLES. A. M. Harunar Rashid (Atomic Energy Centre, Lahore, West Pakistan). J. Nat. Sci. Math., 2: 73-82(Oct. 1962).

The elastic scattering of pions by alpha particles at 300 Mev is calculated using the variational technique which includes the effects of multiple scattering quite simply. The results of the calculation are compared with the experiment on angular distribution and reasonable agreement is obtained. (auth)

9224 NEUTRON-PROTON INTERACTION. V. K. Agrawala and T. V. Ramakrishnan (Banaras Hindu Univ., Varanasi, India). Nature, 196: 761-2(Nov. 24, 1962).

The neutron-proton interaction scheme for the deuteron proposed by Y. P. Varshni (Nature, 182: 1726(1958)) is criticized. It is asserted that the magnetic dipole interaction suggested by Varshni does not lead to a bound state of the deuteron and that the n-p scattering cross section based on this potential is much smaller than the experimentally observed value. It also fails to account for the charge independence of nuclear forces. The slight observed difference between singlet n-p and p-p scattering lengths cannot also be accounted for by purely magnetic dipolar interaction. (L.T.W.)

9225 RADIAL AND ANGULAR DISTRIBUTIONS OF ELECTRONS IN ELECTRON-PHOTON SHOWERS IN LEAD AND IN EMULSION ABSORBERS. H. Messel, A. D. Smirnov, A. A. Varfolomeev, D. F. Crawford, and J. C. Butcher (Univ. of Sydney). Nucl. Phys., 39: 1-88(Dec. 1962).

Results for various electron radial and angular distribution functions are given for the cases of an electron primary energy of 1000 Mev and electron secondary energies greater than 10, 20, 50, 100, 200, and 500 Mev, with depths ranging from zero to 10 radiation lengths in lead and in emulsion absorbers. The calculations are carried out on the electronic digital computer SILLIAC using Monte Carlo methods. One thousand showers are followed in each absorber. Multiple scattering, collision losses, and the Compton effect are taken into account. Bethe-Heitler cross sections for low and high energies are used. (auth)

9226 TWO SETS OF T = 1.0 VECTOR MESONS. Y. Ne'eman and H. Goldberg (Israel Atomic Energy Commission, Rehovoth). Nucl. Phys., 39: 174-6(Dec. 1962).

The $J = 1^-$ resonances ρ, ω, K^*, η, and ξ are interpreted in view of the octet version of unitary symmetry. (auth)

9227 $\Delta S = \pm\Delta Q$-RULE AND THE K_{l3} DECAYS. J. Iizuka and A. Toda (Tokyo Univ. of Education). Phys. Letters, 2: 18-20(Aug. 1, 1962). (In English)

The K_{l3} decays are formulated in terms of dispersion relations assuming that the weak currents include both the $|\Delta\vec{I}| = \frac{1}{2}$ and $\frac{3}{2}$ parts. Data for the muon energy spectrum in $K^+_{\mu 3}$ decays are used to estimate the mixing parameter for the $|\Delta\vec{I}| = \frac{1}{2}$ and $\frac{3}{2}$ currents and in turn that of the $\Delta S = \pm\Delta Q$ amplitudes in K^0_{l3} decays. A possible experimental test of these results is discussed. (H.D.R.)

9228 STATISTICAL MECHANICS OF PARTICLES WITH NEGATIVE ENERGIES. V. Vyšín (Palacky Univ., Olomouc, Czechoslovakia). Phys. Letters, 2: 32-3(Aug. 1, 1962). (In English)

The construction of statistical mechanics of certain systems is very difficult because the integral of state diverges for energies greater than zero and for positive temperatures. Systems of particles with negative energies without a lower limit are assumed to exist in a state of equilibrium with negative temperatures only. The properties of this system with a discrete energy spectrum are formulated. (H.D.R.)

9229 DETERMINATION OF THE $\pi^+ - \pi^0 + e^+ + \nu$ DECAY RATE. P. Depommier, J. Heintze, A. Mukhin, C. Rubbia, V. Soergel, and K. Winter (CERN, Geneva). Phys. Letters, 2: 23-6(Aug. 1, 1962). (In English)

Events of the type $\pi^+ \rightarrow \pi^0 + e^+ + \nu$; $\pi^0 \rightarrow 2\gamma$, have been observed and analyzed. A detailed analysis of the experimental arrangement and the evaluation of events is presented. The e^+ spectrum has the allowed shape with an end point at $E_{\beta max} = 4.0$ Mev. The experimental branching ratio obtained, $(1.7 \pm 0.5) \times 10^{-8}$, is compatible within 1.3 standard deviations with the conserved vector current value. (H.D.R.)

9230 ELASTIC SCATTERING OF γ-QUANTA BY A PARTICLE WITH SPIN $\frac{1}{2}$. V. S. Barashenkov, H. J. Kaiser, and A. A. Ogreba (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Letters, 2: 33-4(Aug. 1, 1962). (In English)

In previous papers the angular and energy dependence of the elastic scattering of γ quanta by an extended system with spin $\frac{1}{2}$ was determined. The quadratic corrections were also obtained, and by comparison with the experimental cross section the electric and magnetic polarizabilities (α and β) were determined. The accuracy of the values of α and β obtained in this way are estimated, and the theory is extended into the region of higher energies by consideration of the third order terms of the expansion. The cubic corrections change α about 15%, β about 100%, and contribute very substantially to the cross section at energies of several hundred Mev and higher. (H.D.R.)

9231 AN ISOMERIC STATE OF THE $_{\Lambda}He^7$ HYPERFRAGMENT. L. R. B. Elton (Univ. of Copenhagen). Phys. Letters, 2: 41-2(Aug. 1, 1962). (In English)

It has been proposed that there exists an isomeric state $_{\Lambda}He^{7*}$, which Λ-decays in preference to going to the ground state through a γ transition. It is assumed here that for the purpose of a radiative transition the Λ in $_{\Lambda}He^7$ acts merely as a spectator, apart from giving a generally greater binding to the nucleons, and that an E2 transition occurs in the γ decay of $_{\Lambda}He^{7*}$. Using these assumptions, the lifetime for this transition is shown to be substantially greater than that of the Λ, so that the isomeric state decays by Λ decay as has been conjectured. (H.D.R.)

9232 MEASURE OF INTERFERENCE BETWEEN RESONANT AND RAYLEIGH SCATTERING OF PHOTONS. J. Miller and J. J. Moine (Centre d'Etudes Nucléaires, Saclay, France). Phys. Letters, 2: 50-1(Aug. 1, 1962). (In French)

The interference between Rayleigh and Mössbauer scattering of photons is calculated in terms of the source velocity, the Rayleigh and nuclear scattering amplitudes, the crystalline properties of the scatterer, the energy and width of the resonant state excited in the Mössbauer transition, and the free-nucleus cross sections. The calculations are carried out and compared with experimental results for the case of scattering of 23.8-kev Sn^{119*} photons by Sn^{119}. (T.F.H.)

9233 ON THE ASSIGNMENT OF STRANGENESS ZERO TO LEPTONS. S. R. de Groot (Univ. of Leiden). Phys. Letters, 2: 55(Aug. 1, 1962). (In English)

The results of assigning strangeness zero to all leptons and isobaric spin of $\frac{1}{2}$ to μ and e leptons are discussed. A relation between charge, third component of isobaric spin, baryon number (B), μ and e numbers (L_μ and L_e), and strangeness (S), valid for all particles, is obtained. B = O, S = O, and hypercharge $B - L_\mu - L_e + S = -1$ for all leptons. (H.D.R.)

9234 ISOSPIN SYMMETRY AS A CONSEQUENCE OF THE QUANTUM FIELD THEORY AXIOMS. Yu. V. Novozhilov (Leningrad State Univ.). Phys. Letters, 2: 113-15(Sept. 1, 1962). (In English)

The main ideas of an axiomatic theory of the elementary particle symmetries are presented. The basic idea of this theory is that symmetry properties are determined not only by the space-time transformations but also by the most general features of field dynamics, because symmetry properties themselves are characteristics and a result of field dynamics. Quantum field theory axioms used are positive definiteness of the metric in the Hilbert space, relativistic invariance, absence of negative energy states, and uniqueness of the vacuum state. Gauge invariance of the theory in the presence of an electromagnetic field is also explored. (H.D.R.)

9235 ON A CONJECTURE OF C. N. YANG. J. S. Bell (Univ. of Washington, Seattle and CERN, Geneva). Phys. Letters, 2: 116(Sept. 1, 1962). (In English)

In a previous work C. N. Yang characterizes the "super" state of a system of identical fermions by the existence for a reduced density matrix, considered as an identical operator, of a large eigenvalue, proportional to the volume of the systems. The density matrix of lowest order with such a large eigenvalue contains a set of fields which he refers to as the "basic unit." This work gives a simple proof of his conjecture that the basic unit must contain an even number of fermions. (H.D.R.)

9236 ON A POSSIBLE $\Xi-\pi$ RESONANCE. A. P. Balachandran and H. Pietschmann (Universität, Vienna). Phys. Letters, 2: 126-7(Sept. 1, 1962). (In English)

The possibility of a low-energy $\Xi-\pi$ resonance is investigated by a unitary octet treatment. The Y_1^*, N^{**}, and Y_0^{**} are classified into the octet, assuming that Y_1^* is a D_3, resonance. The $\Xi-\pi$ resonance would be expected in the $T = \frac{1}{2}$ state with a mass of 1460 Mev and an odd parity with respect to the nucleon. Possible production mechanisms of the resonance are discussed. (H.D.R.)

9237 EXPERIMENTAL OBSERVATION OF SOME REGULARITIES IN μ^+ REPOLARIZATION. S. Gorodetzky (Institut de Recherches Nucleaires, Strasbourgh), Th. Muller, M. Port, and A. Zichichi. Phys. Letters, 2: 133-5(Sept. 1, 1962). (In English)

The μ^+ repolarization as a function of externally applied longitudinal magnetic fields was measured for carbon, sulphur, a plastic scintillator (NE-102), and water. All materials showed a low-field (≤ 1 k gauss) repolarization, and a saturation effect in the repolarization at ~4 k gauss upward. The carbon depolarization at zero field was ~25% and was fully restored at ~4 k gauss. The depolarization in the plastic scintillator was restored to 90% at 10^3 gauss, and fully polarized at ~4 k gauss. In no material did the measurements agree with simple muonium formation theory. (H.D.R.)

9238 "UNIVERSALITY" AND HIGH ENERGY TOTAL CROSS SECTIONS. P. G. O. Freund (Université, Geneva). Phys. Letters, 2: 136-7(Sept. 1, 1962). (In English)

The experimentally observed $\sigma_{tot\ Kp} \simeq \sigma_{tot\ \pi p}$ at high energies indicates that in terms of the Regge formalism of strong interactions the Pomeranchuck pole couples universally to the K and π mesons. A more extensive treatment of the idea of universality for the Pomeranchuk pole coupling is shown to lead to the relations $\sigma_{tot\ pp} \simeq 2\sigma_{tot\ \pi p} \simeq 2\sigma_{tot\ Kp} \simeq 4\sigma_{tot\ \pi\pi} \simeq 4\sigma_{tot\ \pi K} \simeq 4\sigma_{tot\ KK}$ in the high energy limit and to the independence of the diffraction pattern in high energy elastic scattering from the particular process considered. (H.D.R.)

9239 SPECTRAL REPRESENTATIONS OF THE MASS AND POLARIZATION OPERATORS AT ARBITRARY TEMPERATURES. V. L. Bonch-Bruevich (Moscow State Univ.). Phys. Letters, 2: 146-8(Sept. 1, 1962). (In English)

The spectral representation of the mass operator at zero temperature is generalized to the case of an arbitrary temperature. For convenience, retarded and advanced Green functions are used because they possess simple analytic properties at any temperature. In a like manner, photon or phonon retarded or advanced Green functions are used to define the polarization operator. (H.D.R.)

9240 MEASUREMENT OF BINDING ENERGY OF DEUTERONS. W. Rudolph and H. U. Gersch (Zentralinstitut fur Kernphysik, Rossendorf, Ger.). Phys. Letters, 2: 148-9(Sept. 1, 1962). (In German)

The binding energy of the deuteron is measured as 2224.9 ± 1.3 kev, by using a Compton spectrometer to analyze the gamma spectrum resulting from the capture of thermal neutrons by protons. (T.F.H.)

9241 THE ASYMPTOTIC BEHAVIOUR OF THE SCATTERING AMPLITUDES AND THE RENORMALISATION GROUP METHOD. B. A. Arbusov, A. A. Logunov, A. N. Tavkhelidze, and R. N. Faustov (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Letters, 2: 150-2 (Sept. 1, 1962). (In English)

Differential equations of the renormalization group with respect to the momentum transfer are used to find the asymptotic behavior of the scattering amplitude at high energies (S). Application of the method is illustrated by two models of the quantum field theory, establishing an interesting relation between the invariant charge and the Regge exponent. The class of diagrams taken into account also gives an essentially larger contribution to the asymptotic behavior in "S" than those corresponding to the terms previously obtained by summing the "principle" logarithmic diagrams. (H.D.R.)

9242 A POSSIBLE EXPERIMENTAL DETERMINATION OF THE UNIVERSAL CONSTANT ι IN THE QUANTISED PROBABILITY AMPLITUDE FIELD THEORY. Yu. M. Lomsadze, I. Yu. Krivskii, and I. V. Khimitch (State Univ. of Uzhgorod, Ukrainian SSR). Phys. Letters, 2: 218-19(Oct. 1, 1962). (In English)

The value of ι is the degree of "the inside chaotic state" of the elementary particles in quantized probability-amplitude field-theory. Present experimental facts are explainable by the new theory for any arbitrary value of ι, but experiments in their usual form cannot give information about the realization of a particular value of the constant ι in nature, and in particular, answer the question of whether the really observed elementary particles possess any degree $\iota \neq 1$. An experimental test of the consequences of the quantized probability-amplitude field-theory is proposed that may permit the determination of the value of the new universal constant ι realized in nature. (H.D.R.)

9243 THE PRODUCTION AND DECAY OF A C^{14}-HYPERFRAGMENT. B. Bhowmik (Univ. of Delhi). Phys. Letters, 2: 220-2(Oct. 1, 1962). (In English)

An example of a C^{14}-hyperfragment has been observed

during a systematic study of hyperfragments produced by the interactions of K^- mesons and Σ^- hyperons in nuclear emulsion. A photomicrograph of the event is shown, and the possible production reactions are examined. On the grounds of hyperfragment unique range and on considerations of decay kinematics, the event is labeled as the production of a C^{14}-hyperfragment from the interaction $\Sigma^- + N^{14} \rightarrow {}_\Lambda C^{14} + n$, which subsequently decays mesonically via the mode ${}_\Lambda C^{14} \rightarrow N^{14} + \pi^-$, giving a binding energy $B_\Lambda({}_\Lambda C^{14}) = 14.6 + 0.6$ Mev. (H.D.R.)

9244 LIMITATION OF VELOCITY OF DECREASE OF AMPLITUDES IN VARIOUS PROCESSES. V. N. Gribov (AF IOFFE Physical and Technical Inst., Leningrad) and I. Ya. Pomeranchuk. Phys. Letters, 2: 239-41(Oct. 1, 1962). (In English)

Previous work has shown that the asymptotic behavior of the S-matrix element A(s,t) for the transformation of two particles into two particles at high energies, S, and at a fixed momentum transfer, t, is determined by the singularities of the partial wave amplitudes, $f_l(t)$, as functions of the angular momentum, l, in the channel where t represents the energy. Equations are derived to show that in relativistic theory the $f_l(t)$ have for any value of t singularities when $\mathrm{Re}\ l \geq -1$ and accordingly that the amplitude A(s,t), whatever the value of t, cannot decrease faster than 1/s. This conclusion is valid for the amplitude of any two particle process. (H.D.R.)

9245 THE EXISTENCE OF TWO NEUTRINOS AND THE ANALYSIS OF THE LEPTONIC CURRENTS STRUCTURE IN STRANGENESS NON-CONSERVING PROCESSES. B. D'Espagnat (CERN, Geneva and Faculté des Sciences, Orsay, France). Phys. Letters, 2: 241-2(Oct. 1, 1962). (In English)

A discussion is presented on the structure of the leptonic currents governing the strangeness nonconserving weak interactions of strange particles. These interactions involve at least three different strangeness nonconserving currents, G_i(i = 1,2,3), and each of these can a priori be coupled with a leptonic current of its own, having the general form $(\bar{e}\nu_i) + (\bar{\mu}\nu'_i)$, where ν_i and ν'_i are six arbitrary linear combinations of ν and ν'_i. A more reliable procedure than the assumption of special cases is the experimental determination of the numerical coefficients in the linear combinations ν_i, ν'_i. It is pointed out that, although the complete determination of these coefficients requires difficult high-energy neutrino experiments, a complete analysis of the K^0_{e3} decays presently under study can give a partial answer to the problem. (H.D.R.)

9246 K_1^0-K_2^0 MASS DIFFERENCE AND THE BOSON-POLE APPROXIMATION IN STRANGENESS VIOLATING NON-LEPTONIC WEAK PROCESSES. S. Oneda (Kanazawa Univ., Japan), S. Hori, M. Nakagawa, and A. Toyoda. Phys. Letters, 2: 243-6(Oct. 1, 1962). (In English)

An understanding of the complexity of renormalization effects due to strong interactions on weak reactions in terms of some simple mechanism is attempted in order to obtain a deeper insight into the structure of weak interactions. The effects of boson-pole terms on the $|\Delta S| = 1$ non-leptonic processes in connection with the problem of K_1^0-K_2^0 mass difference are examined. Contributions to the mass difference are investigated for a single boson field, the K-π vertex, the K-η vertex, and the scalar $\iota = 0$ boson decaying into two pions. (H.D.R.)

9247 THE HYPOTHESIS OF REGGE POLES AND POLARISATION PRODUCED IN HIGH ENERGY NN SCATTERING. Y. Hara (Tokyo Univ. of Education). Phys. Letters, 2: 246-7(Oct. 1, 1962). (In English)

High energy p-p and p-$\bar{\text{p}}$ elastic scattering cross sections and the polarization produced in p-p and p-$\bar{\text{p}}$ scattering are expressed in terms of pole-residues and trajectories of the exchanged Regge poles. It is shown that the measurement of the ratio $(d\sigma^{(p-p)}_{unp}/dt) : (d\sigma^{(p-\bar{p})}_{unp}/dt)$ is an important test of the hypothesis of Regge poles and that there is a possibility that polarization is observed at high energies. (H.D.R.)

9248 DECAYS OF VERY UNSTABLE PARTICLES. S. L. Glashow (Univ. of Copenhagen). Phys. Letters, 2: 251-2(Oct. 1, 1962). (In English)

A discussion is presented of the decays of unstable particles so short-lived that the usual Weisskopf-Wigner approximation must be modified. Three general unstable decay states are defined and discussed in regard to their line shapes, mean energies, and branching ratios. The specific decay modes are analyzed for the hyperon isobars in Y_1^* and Y_0^{**} decays, the possibility of the neutral resonant state of the $\bar{K}$-K system at 1020 Mev as a vector state, and the four-pion mode of ρ decay. (H.D.R.)

9249 PRODUCTION OF ρ^0 MESONS AT 12 AND 17 Gev/c. D. O. Caldwell, E. Bleuler, B. Elsner, L. W. Jones, and B. Zacharov (CERN, Geneva). Phys. Letters, 2: 253-4(Oct. 1, 1962). (In English)

Interactions of 12- and 17-Bev/c negative pions in a CH target were observed in which two charged particles emerge in the forward direction with nearly all the incident energy. The angles and momenta of the high-energy $\pi^+ - \pi^-$ pair were measured to determine for each event the mass of the short-lived neutral parent, and the masses obtained are plotted. All the events were considered to be pion pairs, although there is evidence that some of the events were $K^+ - K^-$ pairs. The peak dominating the mass spectrum is that of the ρ^0 meson, only appearing at a lower energy and much narrower than previously reported. A second peak appearing in the mass diagram is examined, and the comparison of the mass spectrum with the one-pion exchange model is discussed. (H.D.R.)

9250 HOW DIFFERENT IS THE REGGE TRAJECTORY OF THE ρ-MESON FROM A STRAIGHT LINE? P. G. O. Freund (Univ. of Chicago). Phys. Letters, 3: 123-4(Dec. 15, 1962). (In English)

In the Chew-Frautschi plot, the particle trajectories are supposed to have smoothly varying slopes of ~ 1 Bev^{-2}. An attempt is made to show that due to threshold singularities a whole class of trajectories cannot exhibit such a behavior. The ρ-meson is considered as a typical example of this class, and a simple explanation is given of the "anomalously" small effects of the ρ-trajectory in the physical region ($t \leq 0$). It is concluded that the effects on high energy scattering of a Regge-trajectory seem to be as sensible to phase space as are the resonance widths of the particles situated on it. (H.D.R.)

9251 MEASUREMENT OF THE POLARIZATION OF THE FRASCATI 1-Gev ELECTRON SYNCHROTRON γ-RAY BEAM FROM A DIAMOND CRYSTAL RADIATOR. G. Barbiellini, G. Bologna, G. Diambrini, and G. P. Murtas (Comitato Nazionale per l'Energia Nucleare, Rome). Phys. Rev. Letters, 9: 396-9(Nov. 1, 1962).

Results are given from calculations and measurements of the polarization of a 150-Mev photon line in the spectrum of a 1-Bev bremsstrahlung beam obtained with a diamond radiator. Calculations are performed to define the polarization of the entire γ beam, and the polarization is plotted as a function of the angle between the incident electron momentum and a reciprocal lattice axis. Measurement of the polarization depends upon the fact that in electron pair production from linearly polarized photons the electrons are

emitted preferentially in the plane determined by the direction of the incident photon and the polarization vector. The experimental results are tabulated and compared to the theoretical data. (H.D.R.)

9252 MEASUREMENT OF THE BRANCHING RATIO FOR PION BETA DECAY. Robert Bacastow, Tom Elioff, Rudolph Larsen, Clyde Weigand, and Thomas Ypsilantis (Univ. of California, Berkeley). Phys. Rev. Letters, 9: 400-2(Nov. 1, 1962). (UCRL-10486)

Positive pions at 175 Mev/c were used to investigate the decay process $\pi^+ \rightarrow \pi^0 + e^+ + \nu$. The experiment was designed to detect the two π^0 gamma rays, the positron, and the positron annihilation radiation. Ten events were identified as the desired process and analyzed. The braching ratio was determined to be $2.0 \pm 0.6 \times 10^{-8}$, which is comparable with the prediction of the conserved vector current hypothesis. (H.D.R.)

9253 NEUTRON FORM-FACTOR MEASUREMENT USING ELECTRON-NEUTRON COINCIDENCES. P. Stein, R. W. McAllister, B. D. McDaniel, and W. M. Woodward (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Letters, 9: 403-4 (Nov. 1, 1962).

An electron-deuteron inelastic scattering experiment was performed at incident electron energies of 620 and 350 Mev. The ratio of electron-neutron to electron-proton coincidences was measured at two scattering angles for the interaction $e + d \rightarrow e + n + p$. The data were analyzed in terms of the alternative form factors G_E and G_M. The calculated neutron form factors are $G_{En} = \pm(0.16 \pm 0.04)$ and $G_{Mn} = \pm(1.06 \pm 0.06)$. (H.D.R.)

9254 CONSTRAINTS IMPOSED ON MANDELSTAM REPRESENTATION BY UNITARITY. André Martin (Univ. of Washington, Seattle and CERN, Geneva). Phys. Rev. Letters, 9: 410-14(Nov. 1, 1962).

To determine uniquely the two-body scattering amplitude, it is important to reduce as much as possible the amount of information one has to put in a Mandelstam representation for a given process by making use of unitarity. A previous result based on application of a weak form of unitarity to the high-energy behavior of a scattering amplitude was that if two amplitudes have in common the same double-spectral functions and the same pole terms, their difference consists of a sum of six one-dimensional integrals and one constant. This result is improved by taking into account the existence of purely elastic regions in one or two channels in which the unitarity condition takes the form of an equation instead of an inequality. It is concluded for π-N, π-π, or N-N scattering that if in one channel (s) there is a purely elastic region $S_0 < S < S_1$, where S_1 can be chosen arbitrarily close to S_0, the knowledge of the double-spectral functions $\rho_\mu(s,t)$ and $\rho_t(\mu,s)$ in $S_0 < S < S_1$ determines completely the three double spectral functions and the pole terms in the u and t channels. For π-π and π-N scattering, but not for N-N scattering which is connected by crossing to N-$\bar{N}$ scattering only, if there is a purely elastic region in a second channel (μ), the same amount of information determines the amplitude completely. (H.D.R.)

9255 CIRCULAR POLARIZATION OF HIGH-ENERGY γ RAYS BY BIREFRINGENCE IN CRYSTALS. N. Cabibbo (Comitato Nazionale per l'Energia Nucleare, Rome and Università, Rome), G. Da Prato, G. De Franceschi, and U. Mosco. Phys. Rev. Letters, 9: 435-7(Nov. 15, 1962).

It was shown in a previous work that thick single crystals can be used as polarizers and polarimeters for high-energy gamma rays because of coherence effects in pair production. As a consequence of the effects previously discussed, it is shown here that single crystals are also birefringent. This makes it possible to use a crystal of appropriate thickness as the high-energy analog of a quarter-wave length plate to convert linear into circular polarization, and vice versa. In this way it will be possible to produce and analyze circularly polarized gamma beams of very high energy. (H.D.R.)

9256 FINAL-STATE INTERACTIONS IN THE $\pi^- + p \rightarrow K + \bar{K} + N$ REACTION. Gideon Alexander, Orin I. Dahl, Laurance Jacobs, George R. Kalbfleisch, Donald H. Miller, Alan Rittenberg, Joseph Schwartz, and Gerald A. Smith (Univ. of California, Berkeley). Phys. Rev. Letters, 9: 460-4(Dec. 1, 1962).

Results are reported from a study of the reaction $\pi^- + p \rightarrow K + \bar{K} + N$ at six incident momenta ranging from 1.51 to 2.25 Bev/c. The distribution in momentum transfer to the recoil nucleon is found to be consistent with the assumption that most K-$\bar{K}$ pairs are produced in peripheral $\pi^- + p$ collisions. However, the effective-mass distributions for the $\bar{K}$-N system indicate that an additional contribution to the K$\bar{K}$N final state arises from production of the isotopic spin I = 0 resonant state Y_0^* (1520 Mev), with the subsequent decay $Y_0^* \rightarrow \bar{K} + N$. The K-$\bar{K}$ effective-mass distributions were examined for possible effects due to final-state interactions. Although the K^0-K^- effective-mass distribution is consistent with the phase-space estimate, an enhancement is observed for the neutral K-$\bar{K}$ system in the region $M^2(K_1K_1) \simeq (1.02\ \text{Bev})^2$. A satisfactory fit to the data is obtained if the enhancement is attributed to strong scattering in the I = 0, S-wave K-$\bar{K}$ state. Investigators in a previous study of the reaction $K^- + p \rightarrow \Lambda + K + \bar{K}$ at 2.24 and 2.5 Bev/c have observed a similar enhancement at approximately the same mass, but only final states of the type $\Lambda K_1 K_2$ were found. The relation of the two results is discussed. (H.D.R.)

9257 TOTAL CROSS SECTIONS OF NEGATIVE PIONS IN THE MOMENTUM RANGE 2 TO 5 Bev/c. Michael J. Longo and Burton J. Moyer (Univ. of California, Berkeley). Phys. Rev. Letters, 9: 466-8(Dec. 1, 1962). (UCRL-10174)

Results are presented of π^--p total cross section measurements in the momentum range 2 to 5 Bev/c using counter techniques. A comparison with the results of other experiments shows the data, as a whole, to be inconsistent. Cross sections of π^--carbon scattering were measured at 3 and 4 Bev/c to investigate a discrepancy between the π^+-c cross sections previously measured by the authors and by Wikner. Estimations of total cross sections were extrapolated from the measured cross sections, and good agreement was found between the π^+ and π^- results. (H.D.R.)

9258 PION-PROTON ELASTIC DIFFRACTION SCATTERING AT 3, 4, AND 5 Gev/c. C. C. Ting, L. W. Jones, and M. L. Perl (Univ. of Michigan, Ann Arbor). Phys. Rev. Letters, 9: 468-70(Dec. 1, 1962).

The elastic differential cross sections for π^- scattering on protons at 3.15, 4.13, and 4.95 Bev/c and for π^+ scattering on protons at 2.92 Bev/c were measured in a spark chamber experiment. The data in the diffraction region for these momenta are reported. The data show the predicted exponential behavior for small four-momentum transfers, but no statistically significant shrinkage of the $\pi^- + p$ diffraction peaks over the 3 to 5 Bev/c interval is observed. Comparison with other data to 16 Bev/c also gives little evidence of shrinkage, although data for 15.9 Bev/c have relatively large published errors. This is in contrast to the proton-proton case, where the data are in good agreement with Regge behavior. It is concluded that the $p + p$ and $\pi^- + p$ diffraction elastic scatterings present different behaviors. The influence of trajectories other than the

Pomeranchuk trajectory must be considered to explain diffraction scattering in this energy region by the Regge theory. (H.D.R.)

9259 POSSIBLE EXISTENCE OF A T = 0 VECTOR MESON AT 1020 Mev. J. J. Sakurai (Univ. of Chicago). Phys. Rev. Letters, 9: 472-5(Dec. 1, 1962).

The existence of two T = 0, negative-G vector mesons—one coupled to the baryon current, the other coupled to the hypercharge current—was first discussed within the framework of the vector theory of strong interactions. New, rather weak, evidence for a K-$\bar{K}$ resonance at 1020 Mev has also been found. The possible interpretation of this resonance as the decay of a T = 0, $J = 1^{-2}$ meson is discussed here. The experimental and theoretical consequences of having a T = 0, $J = 1^{-2}$ meson with mass $>2m_K$ in addition to the well established T = 0, $J = 1^{-2}$ ω meson are investigated. (H.D.R.)

9260 DEMONSTRATION OF A POLARIZED He^3 TARGET FOR NUCLEAR REACTIONS. G. C. Phillips (Rice Univ., Houston, Tex.), R. R. Perry, P. M. Windham, G. K. Walters, L. D. Schearer, and F. D. Colegrove. Phys. Rev. Letters, 9: 502-4(Dec. 15, 1962).

Beams of He^{2+} ions at 6.53 and 7.33 Mev were passed through a He^3 gas cell in which metastable 2^3S, He^3 atoms were formed by a weak electric discharge. The percentage polarization in the target was measured by optical means as $8.5\% \times (1 \pm 0.2)$. Calculated and measured values of the polarization (P) are tabulated for alpha-particle bombardment of the polarized He^3 target and are found to be in satisfactory agreement both in magnitude and sign reversal. The 7.33 Mev data are further analyzed by comparing the calculated value of P with the value of P measured for nuclear scattering of alpha particles at two directions of circular polarization of the resonant radiation. The expected reversal of target polarization occurred when the direction of circular polarization was reversed. (H.D.R.)

9261 K^+-p SCATTERING; THE PHENOMENOLOGY OF A REPULSIVE INTERACTION. D. G. Ravenhall (Univ. of Illinois, Urbana). Phys. Rev. Letters, 9: 504-7(Dec. 15, 1962).

Recent experimental data on K^+-proton elastic scattering in the energy range 20 to 450 Mev were analyzed to give the energy dependence of the s-wave phase shift δ, and the energy dependence was fitted to the effective range formula $k \cot \delta = a^{-1} + \frac{1}{2} r_0 k^2$. It is pointed out that the k cot δ expansion is not appropriate for dominantly repulsive interactions, and that when it is used the parameters a and r_0 do not have their usual connotation. The expansion $\delta \simeq -kR + \frac{1}{3} k^3(R - R')^3$ is presented for obtaining a more detailed, but shape-independent, picture of the scattering. The behavior of δ at very low energies is described by the constant length R, and R′ is a length dependent on k^2. The sign of the k^3 term gives the sign of the potential in the outer fringe, and its magnitude measures the "softness" of the potential there. The new data on K^+-p scattering predict that the k^3 term is negative, and thus that the tail is attractive. (H.D.R.)

9262 NOTE ON THE POSSIBLE RESONANT STATE IN THE K$\bar{K}$ SYSTEM. Shigeo Minami and R. W. Huggett (Louisiana State Univ., Baton Rouge). Phys. Rev. Letters, 9: 507-8(Dec. 15, 1962).

Recent experimental data for K^--p collisions at 2.24 and 2.5 Bev/c have shown that the mass spectrum of the K-$\bar{K}$ system in the final state of the reaction $K^- + p \rightarrow \Lambda + K + \bar{K}$ has a peak. If the peak is due to the decay of a K-$\bar{K}$ resonant state, the mass of that state is equal to 1020 Mev. In this note, four cases are examined to determine which isotopic spin state is responsible for the peak. It is concluded that the peak is consistent with a strong interaction in the J = 0 and I = 1 state. A possible model is suggested for the $K^- + p \rightarrow \Xi + \pi + K$ reaction in which the strong K-$\bar{K}$ interaction is taken into account. (H.D.R.)

9263 η-p ELASTIC CHARGE EXCHANGE IN THE Bev ENERGY REGION. H. Palevsky, J. A. Moore, R. L. Stearns, H. R. Muether, R. J. Sutter, R. E. Chrien, A. P. Jain, and K. Otnes (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters, 9: 509-11(Dec. 15, 1962). (BNL-6536)

The η-p elastic charge-exchange cross section has been measured at incident proton energies of 2.04 and 2.85 Bev. The total elastic charge-exchange cross sections obtained were 0.65 ± 0.15 and 0.43 ± 0.16 mb at 2.04 and 2.85 Bev, respectively. The angular distribution of the cross section is peaked in the forward direction and very narrow. Although the proton is believed to be an object about 1 F in size, the present results indicate the existence of some interaction out to distances of 2 F. This interaction is small compared to the core interaction, but seems to provide a particularly sensitive probe for measuring a long weak tail in the nucleon-nucleon interaction. (H.D.R.)

9264 DETERMINATION OF THE TWO-PHOTON DECAY RATE OF THE η MESON. C. M. Andersen, A. Halprin, and H. Primakoff (Univ. of Pennsylvania, Philadelphia). Phys. Rev. Letters, 9: 512-16(Dec. 15, 1962).

The photon decay modes of the η meson may be treated in an entirely similar manner to those of the π^0 meson, since their quantum number assignments are identical. It is suggested that the two-photon decay rate of the η, $\Gamma_{\eta \rightarrow \gamma+\gamma}$, be determined by measuring the Coulomb field contribution to the differential cross section for η photoproduction on a high-Z nucleus using the theory of π^0 photoproduction. Any such determination of $\Gamma_{\eta \rightarrow \gamma+\gamma}$ will also yield the η lifetime. (H.D.R.)

9265 MUONIC λ^0 DECAY. M. L. Good and V. G. Lind (Univ. of Wisconsin, Madison). Phys. Rev. Letters, 9: 518-20(Dec. 15, 1962). (TID-17245)

A clear-cut example of the decay $\Lambda^0 \rightarrow p^+ + \mu^- + \bar{\nu}$ has been observed in an exposure of a hydrogen bubble chamber to a beam of 1.12 Bev/c π^- mesons. The Λ^0 is produced in association with a K^0 meson which decays via $\pi^+\pi^-$. Measured and fitted data are presented for the event, and various other interpretations are examined and shown to have low probabilities. (H.D.R.)

9266 PRECISE NEUTRON AND PROTON FORM FACTORS AT LOW MOMENTUM TRANSFERS. D. J. Drickey and L. N. Hand (Stanford Univ., Calif.). Phys. Rev. Letters, 9: 521-4(Dec. 15, 1962).

The results of a precise measurement of the ratio of elastic electron-deuteron scattering to elastic electron-proton scattering are presented in an attempt to determine the neutron charge form factor G_{En}. The experiment spans the range of momentum transfer $0.3 \leq q^2 \leq 2.2F^{-2}$. In this range, $G_{En} = 0.00 \pm 0.01$ and F_{1n} is therefore negative. Absolute values were obtained for the proton and deuteron form factors (G_{Ep} and G_{Ed}) and, at $q^2 = 1.6F^{-2}$, a straight-line plot is shown verifying the Rosenbluth formula and yielding the proton magnetic form factor G_{Mp} relative to G_{Ep}. The proton rms magnetic and electric radii were found to be equal to 4%. Final values for G_{En}/G_{Ep} are both tabulated and plotted to show the disagreement between an extrapolation of the neutron-electron interaction and the experimental result. (H.D.R.)

9267 ANGULAR DISTRIBUTIONS IN π^+-p ELASTIC SCATTERING IN THE RANGE 500 TO 1600 Mev. Jerome A. Helland, Thomas J. Devlin, Donald E. Hagge, Michael

J. Longo, Burton J. Moyer, and Calvin D. Wood (Univ. of California, Berkeley). Phys. Rev. Letters, 10: 27-9(Jan. 1, 1963). (UCRL-10478)

Angular distributions, differential cross sections, and total elastic cross sections are measured for the π^--p elastic interaction at incident kinetic energies of 533 to 990 Mev and for the π^+-p elastic interaction at 533 to 1555 Mev. The differential cross sections are least-squares fitted to a power series of the form $a_n\cos^n\theta$, where a_n is a constant, n is an integer ≥ 0, and θ is the cms scattering angle. (T.F.H.)

9268 EXISTENCE AND SPIN OF THE PROPOSED "f^0" $\rightarrow \pi^+ + \pi^-$ RESONANCE. J. J. Veillet (Ecole Polytechnique, Paris), J. Hennessy, H. Bingham, et al. Phys. Rev. Letters, 10: 29-31(Jan. 1, 1963).

Analysis of the reaction $\pi^- + p \rightarrow \pi^+ + \pi^- + n$ at an incident π^- momentum of 6.1 Bev/c, in terms of the mass of the outgoing pion pair, gives evidence for the existence of a so-called "f^0" meson. The data yield a mass for this meson of 1260 ± 35 Mev and a width ≤200 Mev. The spin of the particle is conjectured to be 2. (T.F.H.)

9269 DETECTION OF AN INFINITE ANOMALOUS THRESHOLD IN THE REACTION $K^- + p \rightarrow \Sigma + \pi + \pi$. R. Aaron (Indiana Univ., Bloomington). Phys. Rev. Letters, 10: 32-5(Jan. 1, 1963).

It is shown that infinite anomalous threshold in the reaction $K^- + p \rightarrow \Sigma + \pi + \pi$ should give rise to a pronounced peaking in the differential cross section. This peaking is conjectured to be greatest in the region of large ω (energy of two pions in their own cms system), for a K-p cms energy approximately equal to $(M_\omega + M_\Lambda)^2$. It is suggested that experiments on this reaction at K^- lab momenta of 1.18 to 1.21 Bev/c should disclose this peaking, assuming the mass of the ω^0 meson to lie between 766 and 783 Mev. The utility of the experimental investigation as a check on the efficacy of perturbation theoretical analyses of elementary particle interactions is noted. (T.F.H.)

9270 SCATTERING OF MUONS FROM HYDROGEN AT LARGE MOMENTUM TRANSFER. G. E. Masek, T. E. Ewart, J. P. Toutonghi, and R. W. Williams (Univ. of Washington, Seattle). Phys. Rev. Letters, 10: 35-9(Jan. 1, 1963).

The elastic scattering of 1.2-Bev/c μ^- mesons by protons is studied experimentally for momentum transfers of 450 to 850 Mev/c. The experimental arrangement consists of liquid H_2 targets, spark-chamber and Cherenkov detectors, electronic discrimination against pions, and a sextuple coincidence-anticoincidence array. The elastic scattering cross sections and yields are found to be indiscernible from those for the proton-electron elastic interaction. (T.F.H.)

9271 ON THE LEPTON MASSES. A. I. Solomon (Laboratoire de Physique Théorique et Hautes Energies, Orsay, France). Progr. Theoret. Phys. (Kyoto), 28: 663-6 (Oct. 1962). (In English)

An expression is derived for the real mass of a charged fermion that possesses a phenomenological anomalous magnetic moment. In the case of a lepton with a small anomalous magnetic moment arising from the effect of an intermediate vector boson, the resulting expression is shown to be a quadratic equation in the real mass. It is found that an anomalous moment for the lepton small enough not to conflict with observations allows the roots of this equation to be identified with the muon and electron masses. (auth)

9272 ELECTROMAGNETIC STRUCTURE OF THE NUCLEON. II. UPPER LIMITS FOR CONTRIBUTIONS FROM THE THREE-PION STATE. Ken Kawarabayashi (Tokyo Univ.) and Akira Sato. Prog. Theoret. Phys. (Kyoto), 28: 667-74(Oct. 1962). (In English)

Contributions to the isoscalar electromagnetic form factors from the three-pion state in the physical region of nucleon pair annihilation process are estimated by including the effects of pion correlations. The upper limits imposed on the contributions by the unitarity condition are also discussed numerically. It is shown that the results of the perturbation theory for those contributions that give rise to a considerable amount of the magnitude of the charge mean-square radius, are greatly modified and become negligibly small when the pion correlations are correctly taken into account. The unitarity condition, on the other hand, is shown to impose, in effect, no restriction on the three-pion state contribution from the physical region. (auth)

9273 POSSIBLE UNIFIED MODELS OF ELEMENTARY PARTICLES WITH TWO NEUTRINOS. Yasuhisa Katayama (Kyoto Univ.), Ken-iti Matumoto, Sho Tanaka, and Eiji Yamada. Progr. Theoret. Phys. (Kyoto), 28: 675-89(Oct. 1962). (In English)

Possible unified models of elementary particles are discussed assuming the existence of two kinds of neutrino, accompanying the electron and muon. The discussions are focused on the Nagoya model, which is based on the Sakata model of baryons and mesons and the Gamba-Marshak-Okubo symmetry. It is assumed that fundamental particles among baryons and mesons have one-to-one correspondence with leptons or their linear combinations. The correspondence is realized through a kind of "matter." It is also assumed that basic leptons do not transmute each other by the strong interaction between the fundamental baryons. There are two essentially different types of model. One depends on the existence of two neutrinos that are Dirac particles, and the other is related to two Majorana neutrinos. With regard to the models, the difference between the electron and muon and the asymmetry of Λ-pionic decay are also discussed. (auth)

9274 RELATIONS AMONG TOTAL CROSS SECTIONS AT HIGH ENERGIES. Yasuo Hara (Tokyo Univ. of Education). Progr. Theoret. Phys. (Kyoto), 28: 711-30(Oct. 1962). (In English)

A residue of a Regge pole of a partial wave amplitude is shown to be factorized. The high energy behavior of total cross section is shown to be given by a sum over Regge poles. Under specified conditions, relations among total cross sections are obtained. Several conditions to be satisfied by spectral functions of Lehmann's representation (in order that the scattering amplitudes have Regge-pole behavior) are given. (auth)

9275 ELASTIC ETHER THEORY OF ELEMENTARY PARTICLES. [PART] II. Hideo Fukutome (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 28: 731-50(Oct. 1962). (In English)

A theory of relativistic elastic continuum with intrinsic angular momentum (the "gyro-elastic medium") is developed. The Lagrangian of the gyro-elastic medium depends on the third-order "fluidity tensor," as well as the second order strain tensor. It is shown that the Dirac ether is a special case of the gyro-elastic medium, so that the electromagnetic field may be interpreted in terms of the ether model of elementary particles. A spinor formulation of the rotational flow of the gyro-elastic medium is given. It is shown that Heisenberg's "Urmaterie" field may be interpreted as a purely rotational gyro-elastic continuum. (auth)

9276 RELATIONS AMONG POLE RESIDUES OF SCATTERING AMPLITUDES IN MULTI-CHANNEL SCATTERING. Takesi Ogimoto (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), 28: 751-2(Oct. 1962). (In English)

A model with two scattering channels is considered, for which the particles are spinless and neutral. The reactions $\pi + Y \to \pi + Y$, $\pi + Y \to \bar{K} + N$, and $\bar{K} + N \to \bar{K} + N$ are considered as an example of this model. The partial wave amplitudes of these reactions are the boundary values of analytic functions, which can be continued into the second, third, and fourth Riemann surfaces. These partial wave amplitudes are regular in the complex z-plane, except for the branch lines and possible one-particle singularities. Expressions are found relating the residues, at the complex poles, of the scattering amplitudes on each Riemann surface considered. (T.F.H.)

9277 FRAGILE SYMMETRY IN THE STRONG INTERACTIONS. Seitaro Nakamura (Univ. of Tokyo and Nihon Univ., Tokyo) and Shigeo Sato. Progr. Theoret. Phys. (Kyoto), 28: 752-4(Oct. 1962). (In English)

A variant version of symmetry is proposed, in which the resonance processes should violate the complete higher symmetry that otherwise holds in the strong Yukawa-type interactions of baryons and mesons. Thus, it is assumed that the higher symmetry of the resonance transitions forming or dissolving isobars should be different from the Yukawa-interaction symmetry. Quantum numbers and selection rules are obtained in this model. It is expected that processes forbidden by the symmetric strong interaction should take place as resonance reactions. Processes allowed by the selection rules should have two channels, one through the symmetric strong interaction and one through the possible isobars. (T.F.H.)

9278 $\Delta S/\Delta Q = -1$ DECAY AND "INDUCED TRANSITION." Mitsuo Taketani and Takao Tati (Univ. of São Paulo, Brazil). Progr. Theoret. Phys. (Kyoto), 28: 757-9 (Oct. 1962). (In English)

It is shown that the $\Delta S/\Delta Q = -1$ decay of K mesons and hyperons can be understood in terms of a concept of "induced transitions" based on the unified neutrino model. This concept discards the weak interaction hamiltonian and CP invariance. Baryon and meson structures must be taken explicitly into account by means of the Sakata model. The induced transition is expressed as a 6-spinor-type interaction. (T.F.H.)

9279 μ-e PAIR PRODUCTION BY e^+-e^- COLLISION. Toshio Kitagaki (Tohoku Univ., Sendai) and Kiyoshi Nakayama. Progr. Theoret. Phys. (Kyoto), 28: 761-2 (Oct. 1962). (In English)

Predictions for the reactions $e^+ + e^- \to \mu^+ + e^-$, which include both space-like and time-like momentum transfer terms, are presented. An expression is given for the differential cross section, using a phenomenological ($\mu e\gamma$) interaction. The cross section is found to be less than about 10^{-47} cm^2. (T.F.H.)

9280 RESONANCE PARTICLES. R. D. Hill. Sci. Am., 208: 39-47(Jan. 1963).

A review is presented of the production, properties, detection, and analysis of resonance particles. Attention is given to phase-shift properties and Dalitz plots. (T.F.H.)

9281 ON THE ANGULAR DISTRIBUTION FUNCTION OF PARTICLES IN CASCADE SHOWER SMALL ANGLE APPROXIMATION. V. V. Guzhavin. Vestn. Mosk. Univ., Ser. III, No. 4, 60-4(July-Aug. 1962). (In Russian)

Angular distribution functions in small-angle approximation were developed for electrons and photons in cascade showers at any arbitrary stage of shower development, considering multiple and single scatterings. The ionization losses of cascade particles were not considered. (tr-auth)

9282 RESONANCES IN A BARYON SYSTEM WITH A STRANGENESS OF $|S| = 1$. E. V. Kuznetsov and Ya. Ya. Shalamov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teoret. Fiz., 43: 1979-81(Nov. 1962). (In Russian)

The mass insufficiency spectrum, determined on the basis of K^0-mesons in the $\pi^- + N \to K^0(\bar{K}^0) + Y(K, N) + m\pi$, $m = 0.1 \ldots$, reaction involving bound nucleons of the freon and xenon nuclei, was investigated by means of xenon and freon bubble chambers. The impulse of the incident π^- mesons was 2.8 Bev/c. From the photographs taken, stars were selected, accompanied by V^0 events which could be correlated with the point of the interaction. The K^0-mesons were identified by the angle of divergence of the decay products with respect to the trajectory of the disintegrating particles and by measuring the level of ionization and the path of these products. It was found that the K^0 mesons from the reaction $Z^0 \to K^0 + \Lambda^0 + Q$, where Q is the bond energy, being equal to about 40 Mev, yield effective mass (m^*) values which lie within the range from 1.8 to 1.97 Bev, clustered primarily around the highest possible value of $m^* = 1.97$ Bev. (TTT)

9283 FURTHER STUDIES ON THE $\mu^+ \to e^+ + e^+ + e^-$ DECAY. A. I. Babaev, M. Ya. Balats, V. S. Kaftanov, L. G. Landsberg, V. A. Lyubimov, and Yu. V. Obukhov. Zh. Eksperim. i Teoret. Fiz., 43: 1984(Nov. 1962). (In Russian)

In a previous work on this subject (Zhur. Eksper. i Teoret. Fiz. 42, 1685 (1962)) a spark chamber with a fast electronic system was used for studying the $\mu^+ \to e^+ + e^+ + e^-$ decay reaction. The experimental arrangement was improved because in the first study not a single case of the $\mu \to 3e$ decay could be established. The statistics of the system was doubled, corresponding to 1.38×10^9 incidences of μ-mesons on the target. The ability of the system for recording these events was further improved by means of additional calibrations and by making use of new computational techniques. In order to be recorded as a $\mu \to 3e$ decay, the event has to satisfy all the previously established criteria. During the 150 hours of the experiment, not a single such event was recorded. (TTT)

9284 THE $\pi^- + p \to \pi^+ + \pi^- + n$ REACTION AT AN ENERGY 240 Mev, AND $\pi\pi$-INTERACTION. Yu. A. Batusov, S. A. Bunyatov, V. M. Sidorov, and V. A. Yarba (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2015-18(Dec. 1962). (In Russian)

The mass spectrum of a $\pi^+\pi^-$ system is investigated in the 280 to 350 Mev energy range. The spectrum is shifted with respect to phase volume towards large mass values, but no peculiarities of a resonance nature have been observed. Some arguments are presented to prove that the cause of the spectrum shift is $\pi\pi$ interaction in the final state. Possible causes of appearance of the anomaly in π-meson formation in the $p + d \to He^3 + \pi + \pi$ reaction are discussed. (auth)

9285 STIMULATED EMISSION OF RADIATION IN STRONG ELECTROMAGNETIC FIELD. V. I. Serdobolskii (Lebedev Inst. of Physical Chemistry, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2114-21(Dec. 1962). (In Russian)

Stimulated emission of radiation of an atom (molecule) placed in a strong field is calculated by taking into account saturation, the Doppler effect, and field fluctuations in the

incident light wave. It is shown that the amplification regime in a medium with negative absorption and the character of the spectral narrowing may depend on the concentration of the active centers. The existence of a narrowing limit connected with saturation is considered. (auth)

9286 QUANTUM VORTICES IN A FERMION SYSTEM. L. P. Rapoport and A. G. Krylovetskii (Voronezh State Univ., USSR). Zh. Eksperim. i Teor. Fiz., 43: 2122-7 (Dec. 1962). (In Russian)

Superconductivity differential equations for the inhomogeneous case and an arbitrary temperature are derived. It is shown that in a system of fermions in the superfluid state, quantum vortices arise which possess properties similar to those of vortices in a boson system. (auth)

9287 ENERGY LOSSES OF STRONGLY INTERACTING PARTICLES PASSING THROUGH HYDROGEN. Yu. L. Vartanyan (Inst. of Physics, Academy of Sciences, Armenian SSR). Zh. Eksperim. i Teor. Fiz., 43: 2143-5 (Dec. 1962). (In Russian)

Energy losses due to strong interactions are calculated on the basis of experimental data for nucleons and pions passing through hydrogen. (auth)

9288 POLARIZATION OF INELASTICALLY SCATTERED NUCLEONS. Yu. P. Elagin. Zh. Eksperim. i Teor. Fiz., 43: 2166-9(Dec. 1962). (In Russian)

It is shown that for a certain type of inelastic scattering the neutron polarization can be computed within the framework of the optical model. Polarization upon elastic scattering on deformed nuclei is considered. (auth)

9289 PRODUCTION OF π-MESONS IN PION-NUCLEON AND NUCLEON-NUCLEON COLLISIONS. S. M. Bilenkii and R. M. Ryndin (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2204-7 (Dec. 1962). (In Russian)

It is shown that in the extreme case of production of slow π mesons in πN and NN collisions, invariance under time reversal leads to a number of consequences for observable quantities which are independent of the dynamics. Thus, for example, polarization of recoil nucleons during the production of slow π^0 mesons in πN collisions is found to be zero. (auth)

9290 TRANSLATION OF SPIN IN LOBACHEVSKY SPACE. Ya. A. Smorodinskii (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2217-23(Dec. 1962). (In Russian)

Reactions and decays can be described in such a way that upon change of coördinate system the spin does not undergo a Lorentz transformation but a translation on a hyperboloid surface in velocity space. In this case the spin remains a three-dimensional vector and the whole theory of spin effects (addition of spins and their change during scattering) reduces to ordinary nonrelativistic theory. The only correction arises as a result of relativistic spin-orbit coupling (Thomas precession) and can be calculated on basis of simple geometrical considerations. (auth)

9291 NUCLEON-NUCLEON SCATTERING IN THE TWO-MESON APPROXIMATION INCLUDING $\pi\pi$-INTERACTION EFFECT. A. D. Galanin, A. F. Grashin, V. N. Melnikov, and Yu. P. Nikitin. Zh. Eksperim. i Teor. Fiz., 43: 2245-54(Dec. 1962). (In Russian)

With an accuracy to terms $\sim t/4m\mu$, ρ^2/m^2 (μ and m are the pion and nucleon masses and ρ the nucleon momentum), the two-meson absorptive part of the nucleon-nucleon scattering amplitude is calculated for transferred momenta such that $4\mu^2 \leq t \leq 4m\mu$. The $\pi + \pi \rightarrow \bar{N} + N$ amplitude derived by taking into account the effect of $\pi\pi$ interaction in the S, P, and D states is employed. The contribution of pion-pion interaction is significant only in the presence of kinematic resonances for which the $\pi\pi$ amplitude vanishes near the resonance. In the simplest case of a kinematic P resonance at an energy 750 Mev (ρ-meson effect), it has not been possible to make the two-meson approximation results consistent with the experiments pertaining to both the electromagnetic form factors and nucleon-nucleon elastic scattering amplitude. (auth)

9292 ASYMPTOTIC EQUALITY OF THE TOTAL CROSS SECTIONS OF A PARTICLE AND ANTIPARTICLE. N. N. Meiman. Zh. Eksperim. i Teor. Fiz., 43: 2277-80 (Dec. 1962). (In Russian)

The asymptotic equality of the total cross sections $\sigma_+(E)$ and $\sigma_-(E)$ of a particle and its antiparticle is proven under some general assumptions regarding the behavior of the cross-sections at high energies. The rate of decrease of the difference $\Delta\sigma(E) = \sigma_+(E) - \sigma_-(E)$ is investigated. The conclusions are based on some general properties of analytic functions. (auth)

9293 SOLUTION OF THE BETHE-SALPETER EQUATION FOR THE FERMI-YANG MODEL. A. I. Larkin (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz,. 43: 2302-7(Dec. 1962). (In Russian)

Bound states are considered for a nucleon and antinucleon whose interaction can be described by a potential well. The Bethe-Salpeter equations are solved instead of those used by Fermi and Yang. Such a change of the equations leads to the result that the main qualitative predictions of the Fermi-Yang solutions such as a larger well depth or large number of levels disappear. (auth)

9294 MEASUREMENT OF THE POLARIZATION OF D-D NEUTRONS BY A SOLENOID. Pieter Steven Dubbeldam. Thesis, Amsterdam, Vrije Universiteit, 1959. 85p.

A more accurate method of measuring the polarization of fast neutrons from the D-D reaction is described. Theory of polarization and a survey of experiments on the polarization of D-D neutrons are discussed before the method of turning the polarization vector is explained. Turning of the vector is by the Larmor precession of its magnetic moment in the magnetic field of a solenoid directed along the path of the neutrons. Experimental results are presented and analyzed; and the conclusion is reached that within certain limits of the description of the D-D reaction noncentral forces other than the tensor force are present in the nucleon-nucleon interaction. (51 references.) (D.C.W.)

9295 DIFFERENTIAL CROSS SECTIONS FOR D-T NEUTRONS BY TIME OF FLIGHT METHODS. Jan Rethmeier. Thesis, Amsterdam, Vrije Universiteit, 1961. 104p.

Difficulties in measuring energy and angular distributions of elastically and inelastically scattered neutrons with energies between 14 and 15 Mev are discussed. Methods applicable to such scattering measurements are reviewed and compared, and an associated particle, time-of-flight method is deemed most serviceable. The layout of the apparatus used and its performance, are discussed, and the technique for calculating differential cross sections from data obtained (various corrections made) is described. Results of experiments on elastic and inelastic scattering by bismuth and carbon are presented; and the conclusions that differences exist between inelastic scattering of neutrons and that of charged particles, inexplicable in terms of coulomb interactions, and that the associated particle method is the most practicable for such experiments are drawn. (59 references.) (D.C.W.)

9296 NUCLEON FORM FACTORS IN THE STRONG COUPLING MESON THEORY. Reiko Morita. Thesis, New York, Columbia Univ., 1962. 96p.

Expressions for the electric form factors of the proton and neutron were given in the charged scalar and symmetrical pseudoscalar meson theories. Calculations were done in the strong coupling limit. Both theories explain the experimental data given by the Stanford and Cornell groups very well. In the pseudoscalar theory, however, an effective meson mass, which is about one-half of the rest mass, has to be taken. Small effective mass can be understood if a cubic term is introduced in the equation of motion for mesons. In the numerical integration of the equation, the strength $g\sqrt{\lambda}$ was obtained from the boundary conditions, g and λ being the coupling constants of the pion-nucleon and pion-pion fields, respectively. With numerical solutions, the nucleon form factors were recalculated. They fit the experimental data quite well. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9297 THE ENERGY DEPENDENCE OF THE D-D REACTION CROSS SECTION AT LOW ENERGIES. John Joseph Coyne. Thesis, Washington, D. C., The Catholic Univ. of America, 1962. 45p.

The energy variation of the cross section for the D—D reaction can be attributed to the influence of the Coulomb and centrifugal barriers on the approach of the two deuterons. The approach cross section as a function of the energy was calculated using several different methods. The simplest method assumed strong absorption inside the nuclear surface and used the WKB approximation. The results fell on a straight line on a Gamow plot, which is a graph of the natural logarithm of the product of the cross section times the energy as a function of one over the square root of the energy. Thus the slope of the Gamow plot, called the Gamow factor, was a constant. A more accurate strong absorption calculation was performed using exact Coulomb wave functions in place of the WKB approximation. The results gave a negative energy dependent correction to the constant Gamow factor. Strong absorption implies that there is little coherent scattering from inside the nucleus to interfere with the approach of the incident particle. However, in the D—D reaction, coherent scattering from inside the nucleus is very probable, so a weak absorption model seemed more applicable. Calculations were, therefore, carried out using a model that ignores the effect of absorption in calculating the approach cross section. It was found that both positive and negative corrections to the constant Gamow factor were possible with the weak absorption model. Finally, since the amount of absorption seemed important, the effects of absorption were studied using the optical model and varying the ratio of the real and imaginary part of the potential. For very small values of the imaginary part of the potential, the optical model results agreed with the weak absorption model as expected. The calculations, considered so far, included only S-waves. While the experimental results are usually given as a straight line on a Gamow plot, comparison of the results in different energy regions seem to indicate a positive correction to the Gamov factor as a function of the energy. If a more accurate energy dependence for the Gamow factor could be determined experimentally, the comparison of the results with the present calculations would give some information about the optical potential, which one deuteron sees when it approaches another deuteron. (P.C.H.)

9298 OBSERVATIONAL TESTS AND THEORETICAL PROBLEMS RELATING TO THE CONJECTURE THAT THE STRENGTH OF THE ELECTROMAGNETIC INTERACTION MAY BE VARIABLE. Phillip James Edwin Peebles. Thesis, Princeton, N. J., Princeton Univ., 1962. 182p.

Consideration is given to two aspects of the idea that the value of the fine structure constant may be variable in determining the structure of the elementary particles. The first is the theoretical problem of how the idea that the fine structure constant is a function of position is consistent with the results of the Eotvos experiment. A solution to this problem is presented. The second aspect is an observational test of the idea provided by the geophysical data on the ages of rocks and meteorites. It is shown from the data that the fine structure constant has not changed by more than 0.1% in the past 4.5 billion years. (P.C.H.)

9299 SEARCH FOR THE η^0 MESON IN PHOTOPRODUCTION. Anton Stuart Richert. Thesis, Ithaca, N. Y., Cornell Univ., 1962. 153p.

An effort was made to detect the photoproduction of the η^0 meson (a neutral particle of mass 550 Mev) in the reaction $\gamma + p \rightarrow \eta^0 + p$. A magnetic spectrometer with resolution, $\Delta\theta = 1.5^0$, $\Delta p/p = 8\%$, was employed to measure the yield of protons emitted at a given angle and momentum from a liquid hydrogen target exposed to the bremsstrahlung beam from a synchrotron. Fixing the angle, θ_p, and momentum, p_p, of the recoil proton defines the γ energy, k_η, at which the reaction occurs. Thus if the yield is measured as a function of the peak bremsstrahlung energy, k_{max}, any contribution from the reaction under study will occur only for $k_{max} > k_\eta$. There will be an abrupt increase in the yield at $k_{max} = k_\eta$ if the reaction occurs. No evidence for such discontinuous behavior was seen in yield measurements made for $\theta_p = 35^\circ$ and $p_p = 420$, 550, and 638 Mev/c. In each case k_{max} was varied in 25 Mev increments from below the single pion threshold up to about 1100 Mev. The accuracy of the yield measurements was 1%. A statistical analysis of the data shows that the most probable values and standard deviations for the cm differential cross sections for production of a mass 550 Mev particle are -0.38 ± 0.72; 0.43 ± 0.34; 0.23 ± 0.19 μb/sr for p_p = 420; 550; 638 Mev/c. There is no significant evidence that the cross section is different from zero. At present no reliable theory pertaining to the η^0 exists for the interpretation of the results. However, predictions concerning the progress from Sakurai's vector meson theory are presented, and are consistent with the experimental limits. In addition, the data of the yield measurements are employed to deduce values of the differential cross section, $d^2\sigma/d\Omega_p dp_p$, for multiple pion production. The results conform roughly with the phase space for double pion production. Deviations from phase space are partially explained in terms of a pion-proton isobar interaction. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9300 ANNIHILATION OF POSITRONS IN ORGANIC LIQUIDS. James Duncan Hall. Thesis, Austin, Tex., Univ. of Texas, 1962. 99p.

Angular correlation measurements of the two photon radiation from annihilation of positrons in organic liquids were made to obtain momentum distributions for the annihilating positron-electron pairs. The liquids used were benzene, fluorobenzene, chlorobenzene, bromobenzene, iodobenzene, o-xylene, m-xylene, p-xylene, heptane, and heptane with 0.02, 0.06, and 0.67 mole % iodine in solution. One solid, hexamethylbenzene, was also used. The momentum distributions for benzene, fluorobenzene, the xylenes, and heptane showed evidence of two definite components of momentum, the lower one probably arising from positronium formation. The remaining benzene derivatives did

not exhibit two definite components, but showed a reduction in the fraction of annihilations occurring with low momentum as the size of the halide atom increases. A quantitative separation of the components of momentum in benzene was made to obtain the fraction of annihilations occurring with low momentum by two methods, comparison with hexamethylbenzene and comparison with a calculated distribution for the high momentum component. The calculated distribution assumed that the positron wave function was zero within a specified radius for each atom of the benzene molecule and unity outside this distance and that Slater wave functions described the outer shell electrons of the benzene atoms. A value of 0.20 for the fraction of annihilations occurring with the low momentum was obtained by both methods. Values for the fraction of annihilations occurring in the low momentum component and with iodine molecules were obtained for the heptane-iodine solutions. The results are best interpreted by the use of an annihilation or capture cross section for the iodine molecule. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9301 THE PHOTOPRODUCTION OF PION PAIRS FROM HYDROGEN. Martin Feldman. Thesis, Ithaca, N. Y., Cornell Univ., 1962. 145p.

The reactions $\gamma + p \rightarrow p + \pi^+ + \pi^-$, $\gamma + p \rightarrow n + \pi^+ + \pi^0$, and $\gamma + p \rightarrow p + \pi^0 + \pi^0$ were studied for photon energies from 800 to 1200 Mev. The photons were obtained in the form of bremsstrahlung from an electron synchrotron. For each reaction, both of the pions were detected in telescopes that were placed at angles of 50, 70, and 90° on opposite sides of the photon beam. The charged pion telescopes consisted of two scintillation counters and a lucite Čerenkov counter. The neutral pion telescopes contained a total absorption lead glass Čerenkov counter to detect the photons into which neutral pions decay. Because double pion photoproduction is a three body reaction, specifying the pion angles and the incident photon energy is not sufficient to determine the kinematics; therefore integrations were made over all the kinematical possibilities. The principal result is that neutral pion cross sections are proportional to phase space, but charged pion cross sections tend to peak in the forward direction. A possible theoretical explanation of this effect is discussed. A summary of recent experimental work on the forces between pions is also given. (Dissertation Abst., 23: No. 5, Nov. 1962)

9302 THE SCATTERING OF 3.7–25 Mev POSITIVE PIONS BY HYDROGEN. Edgar William Jenkins. Thesis, New York, Columbia Univ., 1962. 42p.

The π^+-p scattering cross section was investigated in a laboratory energy range from 3.7 to 25 Mev using a hydrogen bubble chamber. Nine hundred and fifty events were measured. Of these events 338 were caused by incident pions which would have come to rest in the chamber. The 338 events were used to determine the s-wave phase shift within five specific momentum intervals. The s-wave phase shift was found to deviate from a linear dependence on momentum by one and a half standard deviations. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9303 1962 INTERNATIONAL CONFERENCE ON HIGH-ENERGY PHYSICS AT CERN, GENEVA, JULY 4-11, 1962. J. Prentki, ed. 970p. Geneva, European Organization for Nuclear Research, 1962.

Two-hundred-and-seven papers presented at the conference are given. Subjects discussed include pion and nucleon physics, strange particle physics, weak interactions of non-strange particles, and theories of elementary particles and high-energy physics. Separate abstracts were prepared for 173 papers; the remainder has already been abstracted in NSA. (A.G.W.)

9304 ANGULAR DISTRIBUTION IN π^+-p ELASTIC SCATTERING IN THE RANGE 530 TO 1550 Mev. J. A. Helland, T. J. Devlin, D. E. Hagge, M. J. Longo, B. J. Moyer, and C. D. Wood (Univ. of California, Berkeley). p.3-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Elastic scattering of pions with laboratory kinetic energies of 530, 580, 700, 870, and 990 Mev for π^+ and π^- and 1310 and 1550 Mev for π^+ from a liquid-hydrogen target was measured. The value of the differential cross section was measured simultaneously at 21 different angles ranging from 40° to 170° in the pion center-of-mass scattering angle. From the data total elastic cross sections were obtained. (A.G.W.)

9305 MEASUREMENT OF THE CROSS SECTION FOR THE REACTION $\pi^+ + p \rightarrow \pi^0 +$ (CHARGED PARTICLES) UP TO 1.4 Gev. J. F. Detoeuf, Y. Ducros, J. P. Merlo, A. Stirling, B. Thevenet, L. Van Rossum, and J. Zsembery (Centre d'Études Nucléaires, Saclay, France). p.7-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The variation of the cross section for production of π^0's accompanied by secondary charged particles by the reaction $\pi^+ + p$ was measured as a function of the incident pion kinetic energy between 0.37 Bev and 1.37 Bev. The experimental arrangement used is described, and preliminary results are shown. (A.G.W.)

9306 ON THE THRESHOLD ANOMALIES IN pp-SCATTERING. Yu. D. Prokoshkin, V. I. Rykalin, and I. M. Vasilevskii (Joint Inst. for Nuclear Research, Dubna, USSR). p.9-11 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A differential ionization chamber was used in a search for anomalies in the energy dependence of the total cross section of proton scattering near the threshold (288-Mev) of the reaction $p + p \rightarrow d + \pi^+$ and in a range of higher energies (490 to 640 Mev). No anomalies exceeding the measurement error were found in the investigated energy regions. (A.G.W.)

9307 CHARGE EXCHANGE OF STOPPED PIONS ON THE BOUND HYDROGEN NUCLEI. A. F. Dunaitsev, V. I. Petrukhin, Yu. D. Prokoshkin, and V. I. Rykalin (Joint Inst. for Nuclear Research, Moscow). p.12-13 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An apparatus possessing high time resolution and allowing registration of π^0 mesons with an efficiency considerably higher than that of earlier investigations was used in an attempt to discover the charge exchange of π^- mesons stopped in polyethylene, $\pi^- + p \rightarrow \pi^0 + n$. The ratio of the probabilities of π^0 meson production for hydrogen and polyethylene was found to be $W_{H_2}/W_{CH_2} = 290 \pm 40$. (A.G.W.)

9308 THE PANOFSKY RATIO FOR He^3 AND THE ROOT-MEAN-SQUARE RADIUS OF THE TRANSITION $He^3 \rightarrow H^3$. I. V. Falomkin, A. I. Filippov, M. M. Kulyukin, Yu. A. Scherbakov, R. M. Sulya'ev, V. M. Tsupko-Sitnikov, and O. A. Zaimidoroga (Joint Inst. for Nuclear Research, Dubna, USSR). p.14-17 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Six processes allowed by the conservation laws for cap-

ture of stopped negative pions in He^3 are listed. The processes were studied experimentally by stopping pions in a diffusion chamber filled with He^3 at 20 atm pressure. A table shows the number of events of each type found in 8500 photographs. From measurements of selected events it was found that the relative rates of the reactions $\pi^- + He^3 \rightarrow H^3 + \pi^0$ (3) and $\pi^- + He^3 \rightarrow H^3 + \gamma$ (4) were $W_3 = (13.5 \pm 0.9)\%$ and $W_4 = (6.2 \pm 0.7)\%$. The ratio of the rates of reactions (3) and (4), called the Panofsky ratio, was 2.16 ± 0.28. The root-mean-square radius of the transition from He^3 to H^3 was calculated to be $r = (1.24^{+0.30}_{-0.46}) \times 10^{-13}$ cm. (A.G.W.)

9309 RECENT INVESTIGATIONS ON NUCLEON-NUCLEON SCATTERING AT THE DUBNA SYNCHROCYCLOTRON. V. P. Dzhelepov (Joint Inst. for Nuclear Research, Dubna, USSR). p.19-23 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Various experiments on nucleon-nucleon scattering at three energies, 660, 315, and 200 Mev, carried out in the past two years are summarized. In experiments related to the reconstruction of the proton-proton scattering matrix at 660 Mev, the spin-correlation coefficients $C_{nn}(\Theta)$ and $C_{KP}(\Theta)$ and the parameter $R(\Theta)$ describing the rotation of the polarization vector were determined. Attempts were made to determine which of the two most probable phase shift sets for proton-proton scattering at 310 Mev was true; the question remains undecided. Elastic neutron-proton and exchange neutron-deuteron scattering cross sections at 200 Mev were measured. (A.G.W.)

9310 DETERMINATION OF THE AMPLITUDE OF NN-SCATTERING MATRIX AVERAGED OVER ISOTOPIC SPIN STATES AT 660 Mev. L. S. Azhgirey, Yu. P. Kumekin, M. G. Meshcheryakov, S. B. Nurushev, and G. D. Stoletov (Joint Inst. for Nuclear Research, Dubna, USSR). p.23-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Data on nucleon-nucleus scattering were used to obtain information on the amplitudes of the nucleon-nucleon scattering. It was found that in units of 10^{-13} cm the real and imaginary parts of the amplitudes A and C averaged over isotopic spin states for nucleon-nucleon forward scattering at 660 Mev are as follows: $\bar{A}^R = -0.39 \pm 0.04$, $\bar{A}^I = 0.72 \pm 0.04$, $\bar{C}^R = -0.58 \pm 0.20$, $\bar{C}^I = 0.60 \pm 0.11$. (A.G.W.)

9311 PHASE SHIFT ANALYSIS OF NUCLEON-NUCLEON SCATTERING AT 40, 95, 147, 210, 310 Mev. Yu. M. Kazarinov and I. N. Silin (Joint Inst. for Nuclear Research, Dubna, USSR). p.25-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Results of the modified phase shift analysis of nucleon-nucleon scattering in the energy range of 40-310 Mev carried out under the assumption of isotopic invariance of nuclear forces are presented. (A.G.W.)

9312 ELASTIC SCATTERING OF ANTIPROTONS BY PROTONS IN THE ENERGY RANGE 0 TO 60 Mev. A. Hossain, M. N. Kasim, and M. A. Shaukat (Atomic Energy Centre, Lahore, Pakistan). p.30 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A stack of 100 pellicles of Ilford G-5 emulsion was exposed to the 725-Mev/c antiproton beam at the CERN proton synchrotron. The values of the proton-antiproton elastic scattering cross sections obtained in the energy intervals 5-20, 20-40, and 40-60 Mev are tabulated. (A.G.W.)

9313 A FIRST EVIDENCE OF A RADIATIVE DECAY MODE OF THE INTERMEDIATE PION RESONANCE ($M \sim 550$ Mev). C. Mencuccini, R. Querzoli, G. Salvini, and V. G. Silvestrini (Laboratori Nazionali di Frascati, Rome). p.33-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The photonuclear reaction $\gamma + p \rightarrow \eta + p$ was studied with the 1100 Mev electron synchrotron in an effort to observe the possible radiative decay modes of the η particle; $\eta \rightarrow \pi^0 + \gamma$ or $\eta \rightarrow \gamma + \gamma$. The results indicate the presence of one of the following processes: $\gamma + p \rightarrow p + (\gamma + \gamma)$ or $\gamma + p \rightarrow p + (\pi^0 + \gamma)$. The $(\gamma + \gamma)$ or $(\pi^0 + \gamma)$ group is the decay product of a particle of a mass in the interval $500 \lesssim M \lesssim 550$ (if $\gamma + \gamma$) or $530 \lesssim M \lesssim 580$ (if $\pi^0 + \gamma$). In the frame of present knowledge the decaying mass involved can be either an η or ζ_0 particle (if the ζ_0 exists). (A.G.W.)

9314 ω AND ρ PRODUCTION. W. D. Walker, E. West, A. R. Erwin, and R. H. March (Univ. of Wisconsin, Madison). p.42-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962

Data on π^--p interactions for incoming pion momenta of 1.89 and 2.1 Bev/c are presented. It was found that the mass distributions for ρ^-'s are essentially the same at the two energies, but the mass distributions for the neutral ρ's seem qualitatively different at the two energies. The possibility of attributing this energy dependence to interference produced by the two π decay of the ω^0 is suggested. Information on production of ω^0's which supports this possibility is discussed. (A.G.W.)

9315 MULTIPION PRODUCTION BY 2.03-Gev/c π^- IN HYDROGEN. D. D. Carmony, F. Grard, R. T. Van de Walle, and Nguyen-huu Xuong (Univ. of California, Berkeley). p.44-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An analysis of 4-prong events produced by 2.03 Bev/c π^- mesons in the 72-in. hydrogen bubble chamber yielded 633 events of the type $\pi^- + p \rightarrow \pi^- + p + \pi^- + \pi^+$, 283 events of the type $\pi^- + p \rightarrow \pi^- + p + \pi^- + \pi^+ + \pi^0$, and 134 events of the type $\pi^- + p \rightarrow \pi^- + \pi^+ + \pi^- + \pi^+ + n$. Processes involved in each reaction and the possibilities of production of η, ρ, and ω mesons are discussed. (A.G.W.)

9316 PRELIMINARY RESULTS ON THE PRODUCTION AND DECAY PROPERTIES OF THE ω, η, AND ρ MESONS AND OTHER RESONANCES IN π^+-PROTON COLLISIONS AT 2.35, 2.6, AND 2.9 Gev/c. C. Alff (Columbia Univ., New York), D. Colley, N. Gelfand, V. Nauenberg, D. Riller, J. Steinberger, T. H. Tau, H. Brugger, P. Kramer, and R. Plano. p.50-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Preliminary results obtained in an exposure of the Shutt 20-in. H_2 chamber to π^+ mesons of 2.35, 2.62, and 2.90 Bev/c are presented. Conclusions on the production and decay properties of ρ, ω, and η mesons are based on the 8000 events analyzed to date. (A.G.W.)

9317 EXPERIMENTAL DATA ON NEW PION RESONANCES. A. F. Grashin and Ya. Ya. Shalamov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.58-61 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The processes of multiple production of π mesons at the incident π^- momentum 2.8 Bev/c were investigated in the 17-liter bubble chamber filled with a Xe and propane

mixture or with a mixture of two Freons with composition $C_2F_3Cl_3$. Results for the reactions $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ and $\pi^- + n \rightarrow \pi^- + \pi^- + p$ are discussed. (A.G.W.)

9318 TWO-PION RESONANCES PRODUCED IN π^--p COLLISION AT 7.2 Gev/c. M. S. Ainutdinov, S. Ya. Nikitin, Ya. M. Selector, V. N. Shuliachenko, and S. M. Zumbkovskii (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.61-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The production of π mesons in π^--p collisions was studied at 7.2 Bev/c by means of a 25-cm liquid hydrogen bubble chamber in a magnetic field. Effective mass distribution for dipions with different charges, resulting from the following reactions are shown: $\pi^- + p \rightarrow 2\pi^- + 2\pi^+ + m + K\pi^0$ and $\pi^- + p \rightarrow 3\pi^- + 3\pi^+ + n + K\pi^0$, where K is the generally unknown number of π^0. Analysis of the data shows statistically significant resonances with effective masses at 550, 750, and 1000 Mev. Maxima at 315 and 460 Mev are being checked further. (A.G.W.)

9319 EVIDENCE FOR THE ρ^0 MESON IN π^--p INTERACTIONS AT 7/8 Gev/C. C. Grote, J. Klabuhn, J. Klugow, U. Krecker, U. Kundt, K. Lanius, H. W. Meier, S. Nowak, and R. Pose (Institut fur Kernforschung, Berlin). p.64-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

About 12000 pictures from the 24-liter propane bubble chamber exposed to negative pions of 6.8 Bev/c and 8 Bev/c were scanned for inelastic pion-proton interactions with four secondary prongs. The events were measured and analyzed and 131 events of the type $\pi^- + p \rightarrow p + \pi^- + \pi^+ + \pi^-$ were selected. For these events, the following are shown: the nucleon four-momentum transfer, the effective mass spectrum for the π^--π^- and π^+-π^- systems, and the momentum distributions and the angular distributions in the center-of-mass system for the secondary protons, π^+ mesons, and π^- mesons. The distribution of the neutral dipion shows clearly a peak at the mass of the ρ meson. (A.G.W.)

9320 A STUDY OF THE ANNIHILATION OF STOPPED ANTIPROTONS IN HYDROGEN: THE REACTION $\bar{p} + p \rightarrow \pi^+ + \pi^- + \pi^0$. G. B. Chadwick (Oxford Univ.), W. T. Davies, M. Derrick, C. J. B. Hawkins, J. H. Mulvey, D. Radojicic, C. A. Wilkinson, M. Cresti, S. Limentani, and R. Santangelo. p.69-72 of "1962 International Conference High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reaction $\bar{p} + p \rightarrow \pi^+ + \pi^- + \pi^0$ for antiprotons stopping in the Saclay 81-cm hydrogen bubble chamber was studied. A total of 4148 annihilations giving 2-prong events were measured and analyzed. The results are shown on a Dalitz plot. The production of the ρ meson appears to be a dominant feature of the annihilation to three pions. By counting the number of points within the bands shown on the Dalitz plot, the numbers 92, 100, and 100 were obtained for ρ^+, ρ^-, and ρ^0 respectively. The properties of the final state of the annihilation are discussed. (A.G.W.)

9321 PRODUCTION AND DECAY OF THE ρ AND ω MESONS IN ANTIPROTON ANNIHILATION. G. B. Chadwick, W. T. Davies, M. Derrick et al. (Oxford Univ.). p.73-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The annihilation of antiprotons stopping in the Saclay 81-cm hydrogen bubble chamber was studied. A scan for final states of four charged pions ($p + \bar{p} \rightarrow \pi^+ + \pi^+ + \pi^- + \pi^- + n\pi^0$) was made and about 2000 events were measured. Mass distributions for pion pairs are shown. The ρ meson appears, but no evidence for the ζ meson was found. The production, mass, decay, spin, and parity of the ω meson are discussed. (A.G.W.)

9322 ELASTIC SCATTERING AND MULTIPION ANNIHILATIONS OF 3.25 Gev/c ANTIPROTONS IN HYDROGEN. T. Ferbel (Yale Univ., New Haven, Conn.), J. Sandweiss, H. D. Taft, M. Gailloud, T. W. Morris, R. M. Lea, and T. E. Kalogeropoulos. p.76-83 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Antiproton-proton interactions producing two and four charged prongs in the 20-in. BNL liquid hydrogen bubble chamber were studied. 1981 four-prong events were measured and analyzed. Selection criteria and cross sections are tabulated for 4π, 5π, and $>5\pi$ annihilations. Multipion effective mass distributions are shown. Production rates of ρ and ω mesons in 4π and 5π events are listed. A search for ω pair production indicated very little, if any. 3110 two-prong events were measured and analyzed. Total, elastic, annihilation, and meson-production cross sections for these events are given. The angular distribution of elastic events is discussed. (A.G.W.)

9323 ELASTIC SCATTERING AND SINGLE PION PRODUCTION BY 3.0 Gev/c ANTI-PROTONS IN HYDROGEN. Y. Goldschmidt-Clermont, M. Guinea, T. Hofmokl, R. Lewisch, D. R. O. Morrison, M. Schneeberger, and S. de Unamuno (CERN, Geneva). p.84-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

About 4000 photographs taken in the Scalay 81-cm hydrogen bubble chamber with an incident beam of antiprotons from the CERN proton synchrotron were scanned for two-prong events. Measurement and analysis of the events found indicate that the variation of the differential proton-antiproton elastic scattering cross section is markedly different from that of proton-proton scattering. Evidence is presented for the existence of an excited state of the antinucleon-pion system at the same energy as that of the $(3/2,3/2)$ state of the nucleon-pion system. For single pion production the cross section and the angular distribution were compared with the one-pion exchange calculation of Ferrari and Selleri. Appreciably lower experimental cross sections were found. (A.G.W.)

9324 STUDY OF THE ω^0 MESON IN ANNIHILATIONS $p + p \rightarrow K + K + \omega^0$ AT REST. R. Armenteros, R. Budde, L. Montanet, et al. (CERN, Geneva). p.90-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The ω^0 meson was studied in proton-proton annihilations at rest with production of charged and neutral K mesons. The experiment was carried out in the 81-cm hydrogen bubble chamber at the CERN proton synchrotron. The branching ratio of the ω^0 decay into neutral particles and the $\pi^+\pi^-\pi^0$ mode was found to be $(21 \pm 7.5)\%$. A mass of $[779 \pm 1.4(\pm 5)]$ Mev, where the figure in parenthesis is the estimation of a possible systematic error, is proposed for the ω^0. The natural width of the ω^0 is given by $0 \leqq \Gamma/2 \leqq 10$ Mev. The $\pi^+\pi^-\pi^0$ decay mode yields good evidence for the 1^{2-} attribution of the quantum numbers. A Dalitz plot and the effective K-$\bar{K}$ mass distribution for the reaction $\bar{p} + p \rightarrow K + \bar{K} + \omega^0$ are shown. (A.G.W.)

9325 TWO-PION RESONANCES BELOW MASS 900 Mev. C. Richardson (Johns Hopkins Univ., Baltimore), R. Kraemer, M. Meer, M. Nussbaum, A. Pevsner, R. Strand, T. Toohig, and M. Block. p.96-8 of "1962 In-

ternational Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reactions $\pi^+ + d \rightarrow p + p + \pi^+ + \pi^-$(1) and $\pi^- + d \rightarrow p + p + \pi^- + \pi^-$(2) were observed in the Lawrence Radiation Lab. 72-in. bubble chamber exposed to 1.23 Bev/c pions from the bevatron. Histograms of the invariant mass of the $\pi^+\pi^-$ system in reaction (1) are shown. The ρ meson is seen in the vicinity of 700 Mev and higher. There are departures from phase-space in the 620-650 Mev and 550-600 Mev regions of the order of two standard deviations, but the statistics are insufficient to draw firm conclusions. A three-standard-deviation departure from the smoothed background is seen at about 420 Mev. A histogram of the invariant mass of the $\pi^-\pi^-$ system in reaction (2) shows a three-standard-deviation bump near 600 Mev. (A.G.W.)

9326 AN ANALYSIS OF THE PRODUCTION OF η AND ω MESONS BY THE INTERACTIONS OF PIONS WITH DEUTERIUM. T. Toohig (Johns Hopkins Univ., Baltimore), R. Kraemer, L. Madansky, M. Meer, M. Nussbaum, A. Pevsner, C. Richardson, R. Strand, and M. Block. p.99-102 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The 72-in. bubble chamber filled with liquid deuterium was used to study multi-pion resonances occurring in π-D interactions at a beam momentum of 1230 Mev/c. The effective mass distribution for the three-pion system from events fitting the reaction $\pi^+ + d \rightarrow p + p + \pi^+ + \pi^- + \pi^0$ is shown. The peak of the η meson is at 546 Mev; the peak of the ω meson is at 769 Mev. The impulse model of nuclear reactions was used to analyze the events as π-N interactions. The number of η's and ω's produced as a function of the total energy in the π-N center of mass and the production angular distribution of η's and ω's are shown. The absolute cross sections for the production of η's and ω's, at this beam momentum, that subsequently decay by charged modes were determined to be $\sigma_\eta = 0.22 \pm 0.06$ mb and $\sigma_\omega = 1.3 \pm 0.4$ mb. (A.G.W.)

9327 THE DECAYS OF THE η AND THE ω MESONS. M. Meer, R. Strand, R. Kraemer et al. (Johns Hopkins Univ., Baltimore). p.103-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The decays of the η and the ω mesons were studied in the reactions $\pi^+ + d \rightarrow p + p + \pi^+ + \pi^- + \pi^0$ and $\pi^+ + d \rightarrow p + p +$ neutrals. The total cross section for production of η mesons that subsequently decay by a neutral mode was found to be 0.68 ± 0.2 mb. The neutral-to-charged decay ratio for η is 3.1 ± 1.2. The upper limit on the corresponding ratio for ω is $7 \pm 6\%$, and for ρ it is $6 \pm 40\%$. Possible spin and parity assignments for ω and η are suggested. (A.G.W.)

9328 MULTIPLE PION PRODUCTION BY 1275 Mev/c PIONS. M. C. Foster (Univ. of Wisconsin, Madison), M. L. Good, R. P. Matsen, M. W. Peters, G. W. Taufest, and R. B. Willmann. p.108-11 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reaction $\pi^- + p \rightarrow \pi^- + p + \pi^+ + \pi^- + \pi^0$ was studied in the Lawrence Radiation Lab. 72-in. hydrogen chamber. Mass distributions of all neutral combinations of three pions and Dalitz plots of η^0 production and decay are shown. Production cross sections and the isotopic spin of the η are discussed. (A.G.W.)

9329 THE π-π INTERACTION AT LOW ENERGY. A. V. Arefev, Yu. D. Bayukov, Yu. M. Zajtsev, M. S. Kozodaev, G. A. Leksin, V. T. Osipenkov, D. A. Suchkov, V. V. Telenkov, and B. V. Fedorov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.112-14 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ was studied to obtain information on the π^--π^+ interaction. The experimental arrangement and the kinematical selection of events are described. The events were analyzed by the Chew and Low formula. The total π-π cross section as a function of the square of the π-π system total energy is shown. It is concluded that there is a strong interaction in the isotopic spin $T = 0$ state and that the cross section falls with energy. (A.G.W.)

9330 INVESTIGATION OF THE PION-PION INTERACTION AT LOW ENERGIES. L. Lapidus (Joint Inst. for Nuclear Research, Dubna, USSR). p.115-19 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An emulsion chamber technique was used to study the reaction $\pi^- + p \rightarrow \pi^+ + \pi^- + n$; the mean energy of the primary π^- mesons was (240 ± 15) Mev. It was found that the experimental mass spectrum of the $\pi^+\pi^-$ system was shifted in the direction of greater mass values in comparison with the calculated phase space volume. The cause of this shift appears to be a π-π interaction in the final state. Another group studying the same reaction at 340 Mev with the 25-cm liquid hydrogen bubble chamber came to the same conclusions. (A.G.W.)

9331 THEORY OF LOW ENERGY NUCLEON-NUCLEON SCATTERING. D. Amati (CERN, Geneva), E. Leader, and B. Vitale. p.123-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A set of calculated nucleon-nucleon scattering phase shifts is presented and compared with experimental results and with OPEC phases. (A.G.W.)

9332 THE NUCLEON-NUCLEON POTENTIAL FROM DISPERSION THEORY. W. N. Cottingham (University Coll., London) and R. Vinh Mau. p.125-30 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Calculated potentials of four types (spin-spin, tensor, spin-orbit, and central) are compared with phenomenology. The qualitative agreement obtained supports the method of analysis, as first suggested by Mandelstam, of probing into the form of the nucleon-nucleon interaction by calculating first the one-pion, then the two-pion, etc., exchange contributions to the scattering amplitude. (A.G.W.)

9333 ENERGY DEPENDENT MODIFIED PHASE SHIFT ANALYSIS OF LOW ENERGY PROTON-PROTON SCATTERING. H. P. Stapp, H. P. Noyes, and M. J. Moravcsik (Univ. of California, Berkeley and Livermore). p.131-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A qualitative summary of the results of an energy-dependent modified phase shift analysis of proton-proton scattering data between 10 and 382 Mev is presented. (A.G.W.)

9334 FORM OF ONE-PION EXCHANGE POTENTIAL AND CHARGE INDEPENDENCE OF NUCLEON-NUCLEON INTERACTION. G. Breit, M. H. Hull, F. A. McDonald, and H. M. Ruppel (Yale Univ., New Haven, Conn.). p.134-7 of "1962 International Conference on High-Energy Physics

at CERN." Geneva, European Organization for Nuclear Research, 1962. (TID-15995)

Previous tests of charge independence (CI) and of the form of the one-pion exchange potential (OPEP) were continued. The method made use of phase parameter fits obtained on the assumption that the OPEP applies to high L and J. Preliminary results of the CI tests concerned with the OPEP group of phase parameters are given. (A.G.W.)

9335 CALCULATION OF PION-NUCLEON PHASE-SHIFTS FROM DISPERSION RELATIONS. K. Dietz and G. Hoehler (Technische Hochschule, Karlsruhe, Ger.). p.138-40 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A method of improving the Chew-Goldberger-Low-Nambu approach to calculation of pion-nucleon phase shifts from dispersion relations is discussed. Results are shown for the s-wave amplitude Re $f_0^{(-)}$. (A.G.W.)

9336 WIDTH OF THREE-PION RESONANCES. W. R. Frazer and D. Y. Wong (Univ. of California, San Diego). p.144-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The width of I = 0 three-pion resonances was estimated on the basis of a dispersion-theoretic calculation of the three-pion scattering amplitude. A full width of the order of 10 to 20 Mev was found for the ω meson. (A.G.W.)

9337 EVIDENCE FOR A POSSIBLE π-N RESONANCE IN THE $P_{\frac{1}{2}}$, T = $\frac{1}{2}$ STATE. B. T. Feld (Massachusetts Inst. of Tech., Cambridge) and W. M. Layson. p.147-51 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Analysis of the experimental data on the total π^+-p cross sections and the differential elastic π^--p scattering cross sections was carried out for energies between 0.3 and 1.3 Bev. When the π^--p amplitudes for the $D_{\frac{5}{2}}^-$ and $F_{\frac{5}{2}}^+$ states were chosen in agreement with the Breit-Wigner formula having parameters appropriate to the observed peaks in the T = $\frac{1}{2}$ total cross section, it was found that the best fitting of the angular distribution required a T = $\frac{1}{2}$, $P_{\frac{1}{2}}$ resonance near 950 Mev plus non-resonant contributions from other states. (A.G.W.)

9338 CONSEQUENCES OF γ_5 INVARIANCE IN PION-NUCLEON INTERACTIONS. Y. Nambu (Univ. of Chicago). p.153-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

If the pion-nucleon system satisfies γ_5 invariance when the pion mass can be neglected, a specific relation is obtained between the amplitude M for any reaction a → b and the pion production amplitude M_{rad} for a → b + π, where the pion is produced at rest. This relation is applied to the reactions M: e + N → e + N, M_{rad}: e + N → e + N + π and M: ν + N → e + N, M_{rad}: ν + N → e + N + π. Since these reactions actually violate the isotopic γ_5 invariance, a modified formula that takes into account the perturbation Hamiltonian is used to calculate the pion production cross section at the threshold of the pion-nucleon system. (A.G.W.)

9339 PION-NUCLEON SCATTERING AND PION-PION INTERACTIONS. J. Hamilton, P. Menotti, G. C. Oades, and L. L. J. Vick (University Coll., London). p.159-62 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The information that can be obtained about the T = 0 and T = 1 π-π interactions by using the dispersion relations for the s- and p-wave π-N partial waves is discussed. (A.G.W.)

9340 CONSEQUENCES OF THE G QUANTUM NUMBER FOR DECAYS OF THE NEW PARTICLES. G. Feinberg (Columbia Univ., New York). p.168-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

It was indicated previously that the masses and quantum numbers of the multipion states discovered in the last year may be such that electromagnetic effects, involving real or virtual photons, are important in their decays. Such electromagnetic effects are considered for the following: (1) decays of the form A → B + γ, where A is a "multipion resonance" such as ρ, ω, η, B is a state of some number of pions, and γ represents a photon; and (2) decays in which no real photon is emitted, but in which G or T or both change. (A.G.W.)

9341 ON POSSIBLE DECAYS OF NEW MESONS. I. Yu. Kobzarev and L. B. Okun (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.173-6 of "1962 International Conference on High-Energy at CERN." Geneva, European Organization for Nuclear Research, 1962.

The probabilities for different decays of ω^0 and σ^0 mesons are estimated. The estimates are uncertain, but it appears that in several cases the photon decays of σ and ω mesons are comparable with their pion decays. (A.G.W.)

9342 EVIDENCE THAT THE ρ MESON IS COUPLED UNIVERSALLY TO THE ISOSPIN CURRENT. J. J. Sakurai (Univ. of Chicago). p.176-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Experimental and theoretical arguments are presented in favor of the universality hypothesis for the coupling of the ρ meson to strongly interacting particles that bear isospins. (A.G.W.)

9343 CLASSIFICATION OF THREE- AND FOUR-PION SYSTEMS. M. Grynberg and Z. Koba (Inst. Badan Jadrowych, Warsaw). p.178-81 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A scheme of classification of n-pion states is presented according to the increasing order of a parameter $\Lambda = \sum_{i=1}^{n-1} l_i + 2\sum_{j=1}^{n-2} \nu_j$, which expresses the degree of the centrifugal barrier effect, determines the parity, gives the upper limit of the total angular momentum, and thus plays a role similar to the relative orbital angular momentum in the two-body problem. Expected angular correlations for a system of $2\pi^+$ and $2\pi^-$ in the states with $\Lambda \leq 2$ are shown. (A.G.W.)

9344 NEW RESULTS ON THE ELECTROMAGNETIC FORM FACTORS OF NUCLEONS. D. Aitken, R. Hofstadter, E. B. Hughes, T. Janssens, and M. R. Yearian (Stanford Univ., Calif.). p.185-93 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

New apparatus and new techniques used at Stanford University for studying the structure of nucleons are described. The new equipment includes new thin liquid hydrogen and liquid deuterium targets, new Cherenkov detectors for the scattered electrons, and a new multichannel detector for the 1000-Mev spectrometer that can detect either scattered electrons or protons. Preliminary results

on proton and neutron electromagnetic form factors and on coincidence studies of collisions of a fast electron with a free proton or with the proton in the deuteron are reported. (A.G.W.)

9345 ELECTRON-PROTON SCATTERING AT HIGH MOMENTUM TRANSFER. K. Berkelman, R. M. Littauer, and G. Rouse (Cornell Univ., Ithaca, N. Y.). p.194-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Measurements on elastic electron-proton scattering were made by detecting both the scattered electron and the recoil proton, each momentum analyzed. The four-momentum transfer q^2 and the scattering angle θ were chosen as independent variables, and cross sections at $\theta = 110°, 120°, 130°$ (lab system) and $q^2 = 25, 30, 35, 40, 45$ Fermi^{-2} were obtained. From the measured cross sections, proton form factors were determined. (A.G.W.)

9346 MAGNETIC AND ELECTRIC FORM FACTORS. R. G. Sachs (Univ. of Wisconsin, Madison). p.197-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Reasons for introducing the form factors F_{ch} and F_{mag} in place of the usual F_1 and F_2 are given. The high-energy behavior of the form factors is discussed briefly. (A.G.W.)

9347 THE π^0-PRODUCTION IN THE COULOMB NUCLEAR FIELD. V. V. Barmin, Yu. S. Krestnikov, E. V. Kuznetsov, A. G. Meshkovski, Yu. P. Nikitin, and V. A. Shebanov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.199-201 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reaction $\pi^- + Xe \rightarrow \pi^- + \pi^0 + Xe$ was studied in a Xe bubble chamber exposed to 2.8 Bev/c π^- mesons. To determine the proportionality of the Coulomb effect to Z^2 a bubble chamber filled with freon mixture was exposed to the same beam. The main part of the effect depending on Z^2 was concentrated at small angles. The cross section σ_c for $\pi^+ + Xe \rightarrow \pi^- + \pi^0 + Xe$ was found to be (4.4 ± 1.6) mb. (A.G.W.)

9348 PHOTOPRODUCTION OF POSITIVE PIONS FROM HYDROGEN IN THE ENERGY REGION 200 TO 450 Mev. K. Althoff, H. Fischer, C. Freitag, D. Freytag, K. Luebelsmeyer, and W. Paul (Universität, Bonn and Kernforschungsanlage Jülich, Ger.). p.202-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The Bonn 500-Mev strong-focusing electron synchrotron was used to measure the differential cross section between 200 and 450 Mev with a range telescope and a magnetic spectrometer. Angular distributions in the center-of-mass system are shown and compared with other experiments. The data obtained are shown on a $|T^+|^2$ plot as suggested by J. K. Walker (Nuovo Cim. 21, 577(1961)). The bump predicted by Walker in this region does not appear. (A.G.W.)

9349 THE PHOTOPRODUCTION OF π^0 MESONS IN HYDROGEN. D. B. Miller and E. H. Bellamy (Univ. of Glasgow). p.205-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The cross section for π^0 photoproduction from hydrogen at 90° in the center-of-mass was measured. Results are compared with previous experiments and with theoretical calculations. (A.G.W.)

9350 POSITIVE PION PHOTOPRODUCTION ON HYDROGEN NEAR THRESHOLD. M. I. Adamovich, E. G. Gorzhevskaya, V. G. Larionova, N. M. Panova, S. P. Kharlamov, and F. R. Yagudina (Lebedev Physical Inst., Academy of Sciences, Moscow). p.207-11 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reaction $\gamma + p \rightarrow n + \pi^+$ was studied in the photon energy interval from threshold to 200 Mev. The angular dependence of the differential cross sections in the center-of-mass system for the energies 177.4, 190, and 200 Mev and the dependence of the differential cross sections for the angles 16 and 42.5° lab on the photon energy are shown. The experimental results are compared with dispersion theory. (A.G.W.)

9351 PHOTOPRODUCTION OF π^0-MESONS FROM DEUTERIUM. A. S. Belousov, S. V. Rusakov, E. I. Tamm, and L. S. Tatarinskaya (Lebedev Physical Inst., Academy of Sciences, Moscow). p.211-12 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The relative cross sections of deuterium and hydrogen were measured for mesons emerging from the liquid hydrogen (deuterium) target at 0° in the direction of the bremsstrahlung beam. Data are presented as the ratio of the deuterium and hydrogen cross sections. Results agree with theoretical values in the energy interval from 200 to 250 Mev, but below 200 Mev, experimental values are higher than theoretical values. (A.G.W.)

9352 ANGULAR DISTRIBUTION OF THE REACTION $\gamma + p \rightarrow p + \pi^0$ AT A PHOTON ENERGY OF 180 Mev. B. B. Govorkov, S. P. Denisov, and E. V. Minarik (Physical Inst., Academy of Sciences, Moscow). p.213 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The differential cross section for the reaction $\gamma + p \rightarrow p + \pi^0$ was measured for a mean incident γ energy of 180 Mev by measuring the yields of the two photons from π^0 decay at center-of-mass angles 25.8, 45.9, 77, 106.7, 135.8, and 161°. A liquid hydrogen target was used. The data are compared with the results of the dispersion theoretical calculation. (A.G.W.)

9353 PHOTOPRODUCTION OF π-MESONS NEAR THRESHOLD. A. M. Baldin and A. I. Lebedev (Physical Inst., Academy of Sciences, Moscow). p.214-16 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In the cross sections of the reactions $\gamma + p \rightarrow p + \pi^0$ and $\gamma + p \rightarrow \pi^+ + n$ in the vicinity of the angles $\theta = 0$ and 180°, a discrepancy between experiment and prediction on the basis of dispersion relations was previously found. Further investigation indicated that the main sources of the discrepancies were in the inaccuracy of the experimental data and the greater sensitivity of the cross sections to small variations of the dispersion integrals. A more precise evaluation of the dispersion integrals is discussed, which, with new experimental data, sharply decreased the discrepancies. (A.G.W.)

9354 POSSIBLE RESONANT ENHANCEMENT OF THE TWO PHOTON EXCHANGE IN ELECTRON-PROTON SCATTERING. D. Flamm and W. Kummer (CERN, Geneva). p.216-18 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A dispersion theoretical treatment of deviations from

the Rosenbluth formula that could be produced by the two-photon exchange contribution in electron-proton scattering is presented. (A.G.W.)

9355 ON THE POSSIBLE USE OF BREMSSTRAHLUNG TO STUDY HIGH ENERGY INTERACTIONS. D. R. Yennie (Univ. of Minnesota, Minneapolis) and H. Feshbach. p.219-21 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Physics, 1962.

By use of a generalization of an idea of F. Low, it is shown how a study of the bremsstrahlung accompanying a high-energy interaction can be used to obtain new information about the nature of the interaction. In principle, this method permits the direct comparison of the interaction amplitudes at two slightly different energies. For example, in the vicinity of a resonance the amplitude undergoes a large change of phase; and the bremsstrahlung cross section may be considerably modified at energies comparable to the width of the resonance. (A.G.W.)

9356 PROTON COMPTON SCATTERING. V. F. Mueller (Universitat, Heidelberg, Ger.). p.222-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Differential cross sections for elastic scattering by protons were calculated by use of fixed momentum-transfer dispersion relations. No kinematical approximations were made. The approach is based on a more theoretical description of π photoproduction than was used in previous calculations. (A.G.W.)

9357 DISPERSION RELATIONS FOR COMPTON-EFFECT ON A PROTON. N. F. Nelipa and L. V. Fillkov (Lebedev Physical Inst., Academy of Sciences, Moscow). p.225-8 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The one-dimensional dispersion relations (with subtractions) are obtained from the double dispersion relation and used for the analysis of experimental data. The values of the Compton-effect cross section as a function of the photon energy for angles 90 and 135° when $\tau = \infty$ and 2×10^{-16} sec, and the angular distributions for different energies are shown. (A.G.W.)

9358 GAMMA-RAY SCATTERING BY PROTONS AND POLARIZABILITY OF NUCLEONS. L. I. Lapidus (Joint Inst. for Nuclear Research, Dubna, USSR). p.228-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The electric and magnetic polarizabilities of protons α_e and α_m were evaluated separately by analysis of γ scattering by nucleons based on dispersion relations. The results, $\alpha_e \cong 9 \times 10^{-43}$ cm^3 and $\alpha_m \cong 2 \times 10^{-43}$ cm^3, agree with experimental data. (A.G.W.)

9359 A STUDY OF HYPERON-ANTIHYPERON PRODUCTION BY 3, 3.6 AND 4 Gev/c ANTIPROTONS IN HYDROGEN. R. Armenteros, E. Fett, B. French, et al. (CERN, Geneva). p.236-40 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The 81-cm Saclay hydrogen bubble chamber was exposed to a separated beam of antiprotons from the CERN proton synchrotron. From approximately 120,000 photographs obtained at each momenta, interactions from which both a hyperon and an antihyperon were observed to decay in the chamber were studied. Three types of events are discussed: reactions producing neutral hyperons, events of the type $y^+\bar{y}^+$, and interactions producing an additional π meson. The fact that the angular distributions $p + \bar{p} \rightarrow y + \bar{y}$ are strongly asymmetric suggests that the main channel for this type of event may be peripheral. The cross section seems independent of the momentum transfer below 800 Mev/c and decreases rapidly above 1 Bev/c. (A.G.W.)

9360 STRANGE PARTICLE CORRELATIONS IN HIGH ENERGY PION-NUCLEON COLLISIONS. H. H. Bingham (Ecole Polytechnique, Paris), M. Bloch, D. Drijard, A. Minguzzi-Ranzi, and M. Nikolić. p.240-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Results based on 127 selected V^0 pairs produced by π^- of 6, 11, and 18 Bev/c in hydrogen-like collisions in a 1-m bubble chamber filled with a propane-freon mixture are reported. The results confirm that the Λ^0's are peaked backward in the center-of-mass system but with longitudinal momentum distributed roughly uniformly from slightly forward to the maximum kinematically possible backwards. Evidence of similar backward peaking of the nucleon in $K\text{-}\bar{K}^0$ jets was found. The main features of the data cannot be explained by phase space alone, nor by any single naive peripheral model. The Q_{KK} distribution seems independent of beam energy. Preliminary data on correlations among the strange particles and the pions of the $K^0\text{-}\Lambda^0$ producing jets show evidence for K^{*+} and Y_1^* production by 6-Bev π^-. No evidence was seen for K^* production in $K^0\text{-}\bar{K}^0$ producing jets. (A.G.W.)

9361 STRANGE PARTICLE PRODUCTION IN 10 Gev/c π^- INTERACTIONS IN HYDROGEN BUBBLE CHAMBERS. A. Bigi, S. Brandt, R. Carrara, W. A. Cooper, Aurelia de Marco, G. R. MacLeod, Ch. Peyrou, R. Sosnowski, and W. Wroblewski (CERN, Geneva). p.247-51 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The 80-cm Saclay hydrogen bubble chamber was exposed to a 10-Bev/c π^- beam. In 313 events the decay of both strange particles produced was observed in the chamber. Cross sections for strange particle production and Q values for all possible pairs of secondaries produced by $K^0\text{-}\bar{K}^0$ and $K^0\text{-}\Lambda^0$ events were calculated. It appeared that production of $K^0\text{-}\bar{K}^0$ pairs could be explained in terms of a peripheral model with π exchange. It was found that the average transverse momentum of secondaries produced in π^--p interactions was not constant but seemed to depend on the mass of the particle produced. (A.G.W.)

9362 INVESTIGATION OF Λ HYPERON AND K^0 MESON PRODUCTION PROCESSES IN π^--p AND π^--C INTERACTIONS AT 7 TO 8 Gev ENERGY. V. A. Belyakov, Wang Yung-chang, V. I. Veksler, et al. (Joint Inst. for Nuclear Research, Dubna, USSR). p.252-60 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Production of Λ hyperons and K^0 mesons in π^--p interactions at 7-8 Bev was studied with the 24-liter propane bubble chamber. Data shown in figures include center-of-mass system angular and momentum distributions of Λ hyperons, K^0 mesons, and charged particles accompanying Λ and K^0 production. Results are compared with predictions of statistical theory. Angular and momentum distributions of Λ and K^0 produced in π^--C interactions and angular distribution of protons from Λ decay are also shown. (A.G.W.)

9363 A STUDY OF ΛK^0 AND $K^0\bar{K}^0$ PAIR PRODUCTION IN π^-p AND π^-C INTERACTIONS AT THE π^- MESON MOMENTUM OF 7 TO 8 Gev/c. V. A. Belyakov, Wang Yung-chang, V. I. Veksler, et al. (Joint Inst. for Nuclear Research, Dubna, USSR). p.261-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Photographs of π^--p interactions in the 24-liter propane bubble chamber were scanned for Λ-K^0 and K^0-$\bar{K}^0$ pairs. Data shown in figures include angular and momentum distributions of Λ hyperons and K^0 mesons from Λ-K^0 pairs and K^0 mesons from K^0-$\bar{K}^0$ pairs. The angular distributions of "single" K^0 mesons, K^0 mesons from K^0-$\bar{K}^0$ pairs, and K^0 mesons from Λ-K^0 pairs are compared. Momentum and angular distributions of π^+ mesons which accompany the Λ-K^0 pairs are shown. Investigations of π^--C pair events are incomplete. (A.G.W.)

9364 PHOTOPRODUCTION OF K^+ MESONS IN HYDROGEN. B. D. McDaniel, R. L. Anderson, E. Gabathuler, D. P. Jones, A. J. Sadoff, and H. Thom (Cornell Univ., Ithaca, N. Y.). p.266-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Measurements of the photoproduction of K^+ mesons from hydrogen using the Cornell 1.4-Bev synchrotron were improved by an increased beam intensity and a time-of-flight technique for K-meson identification. Differential cross sections for the reactions $\gamma + p \rightarrow K^+ + \Lambda^0$ and $\gamma + p \rightarrow K^+ + \Sigma^0$ are shown. A preliminary experiment on polarization of the Λ^0 in K^+-Λ^0 production is described briefly. (A.G.W.)

9365 ASSOCIATED PRODUCTION EXPERIMENTS NEAR 1 Gev/c. F. S. Crawford (Univ. of California, Berkeley). p.270-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Seven experiments involving associated production by π^- and π^+ in the Alvarez 72-in. hydrogen chamber are summarized. The experiments include the following: charge independence in $\pi + p \rightarrow \Sigma + K$ at threshold and at 1170 Mev/c; the mass difference $M(\Sigma^0) + M(K^0) - M(\Sigma^-) - M(K^+)$; the reaction $\pi^- + p \rightarrow \Lambda + K^0$ at ΣK threshold; parity conservation in $\pi^- + p \rightarrow \Lambda + K^0$; lower limit for $|\alpha_\Lambda|$; charge symmetry of K^+ and K^0 in the associated production process. (A.G.W.)

9366 SYSTEMATICS OF Σ PRODUCTION FROM THE INTERACTIONS OF PIONS WITH DEUTERIUM. R. Kraemer, M. Nussbaum, L. Madansky, and A. Pevsner (Johns Hopkins Univ., Baltimore). p.273-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The Berkeley Bevatron and the Alvarez 72-in. bubble chamber filled with deuterium were used in investigating charged Σ hyperon production in $\pi^\pm$-deuterium interactions. Invariant mass histograms for the reactions $\pi^+ + d \rightarrow \Sigma^+ + K^+ + n$ and $\pi^- + d \rightarrow \Sigma^- + K^+ + n$ are shown. Comparison of experimental distributions with phase space predictions indicates that strong final state interactions are small if present at all in these processes. Total cross sections were determined as follows: for $\pi^+ + p + (n_s) \rightarrow \Sigma^+ + K^+ + (n_s)$, (0.171 ± 0.031) mb; for $\pi^+ + n + (p_s) \rightarrow \Sigma^+ + K^0 + (p_s)$, (0.177 ± 0.033) mb; for $\pi^- + p + (n_s) \rightarrow \Sigma^- + K^+ + (n_s)$, (0.200 ± 0.028) mb; for $\pi^- + n + (p_s) \rightarrow \Sigma^- + K^0 + (p_s)$, (0.185 ± 0.035) mb, where n_s and p_s represent the noninteracting nucleon. (A.G.W.)

9367 ΣK PRODUCTION IN THE 72" BUBBLE CHAMBER. J. R. Albright, T. O. Binford, U. Camerini, et al. (Univ. of Wisconsin, Madison). p.276 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reactions $\pi^- + p \rightarrow \Sigma^- + K^+$, $\pi^- + p \rightarrow \Sigma^0 + K^0$, and $\pi^+ + p \rightarrow \Sigma^+ + K^+$ were studied. The result of the triangle charge independence check is shown. (A.G.W.)

9368 STUDY OF THE K* RESONANCE IN ($\bar{p}p$) ANNIHILATIONS AT REST. R. Armenteros, L. Montanet, D. R. O. Morrison, et al. (CERN, Geneva). p.295-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In the stopped antiproton experiment carried out at the CERN proton synchrotron with the Saclay hydrogen bubble chamber, significant bumps corresponding to K* production were observed both in the three-body ($K^0_1K\pi$) and four-body ($K^0_1K\pi\pi$) annihilations. The K-π effective mass distribution in the four-body annihilation is shown. A method proposed by Schwartz (Phys. Rev. 6, 556(1961)) to obtain the spin of the K* from the reaction $\bar{p} + p \rightarrow K^0 + \bar{K}^{0*}$ ($\bar{K}^0 + K^{0*}$) is discussed in relation to the data of this experiment. It is concluded that, if the annihilation is from an S-state, the spin of the K* is not zero to the uncertainty implied in comparing (36.5 ± 15) events to zero. (A.G.W.)

9369 INTERACTIONS OF 1.47 Gev/c NEGATIVE K^--MESONS IN HYDROGEN. W. A. Cooper, H. Courant, H. Filthuth, et al. (CERN, Geneva). p.298-302 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

From photographs taken with the CERN 32-cm hydrogen bubble chamber in a 1.47 Bev/c K^--meson beam, 500 events have been analyzed. A preliminary estimate of some of the partial cross sections is given. Mass distributions for the reactions $\Sigma^+\pi^+\pi^0$ and $\Sigma^+\pi^+\pi^-\pi^+$ both show resonances at masses of 1.40 and 1.52 Bev. In the three-body reaction, a secondary peak is also indicated around 1.67 Bev. The mass distribution of the $\pi^+\pi^-\pi^0$ system for the $\Lambda^0\pi^+\pi^-\pi^0$ reaction shows the ω peak clearly at 786 ± 5 Mev. The center-of-mass angular distribution of the pion in several two-body reactions is shown. In all cases the distributions show a forward peaking of the pion, but the peaking is more pronounced when the baryon charge is positive or zero. The mass spectrum of the $\bar{K}^0\pi^-$ system for the $\bar{K}^0 p \pi^-$ reaction shows that about 80% of the events fall in the peak of the K* of mass 885 Mev. (A.G.W.)

9370 RESONANCES IN STRANGE PARTICLE PRODUCTION. D. Colley (Columbia Univ., New York), N. Gelfand, U. Nauenberg, J. Steinberger, S. Wolf, H. R. Brugger, P. R. Kramer, and R. J. Plano. p.315-19 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In an exposure of propane to 2.0 Bev/c π^- mesons at the Cosmotron in the Columbia 30-in. chamber, the following reactions were analyzed for resonances between the particles present in the final state: (1) $\pi^- + p \rightarrow \Lambda^0 + \pi^- + K^+$; (2) $\pi^- + p \rightarrow \Sigma^+ + K^0 + \pi^-$; (3) $\pi^- + p \rightarrow \Lambda^0 + K^0 + \pi^0$. Evidence was seen that not only the Y_1^* but also the K' were produced in $\Lambda^0K\pi$ production. There was no evidence for a $K\pi$ resonance at 730 Mev. The 1404 and 1525 $\Sigma\pi$ resonances were observed. The most probable interpretation of the observed angular correlation in the Y_1^* decay requires that the Y_1^* spin be greater than $\frac{1}{2}$. If the Y_1^* spin is then assumed to be $\frac{3}{2}$, the relative parity of the Y_1^* and the Λ^0 must be even to account for the Λ^0 polarization. However, if the Y_1^* has spin $\frac{1}{2}$, the parity must be odd. (A.G.W.)

9371 POSSIBLE CLASSIFICATION OF PARTICLES AND RESONANCES. A. H. Rosenfeld (Univ. of California, Berkeley). p.325-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Two schematic figures are shown in which the new particles or resonances are arrayed on possible Regge trajectories. A notation system is suggested. (A.G.W.)

9372 MASS SPECTRUM OF THE 1385 Mev $\Lambda^0+\pi^0$ RESONANCE FROM 1.5 Gev/c π^- MESONS ON PROTONS. C. T. Coffin, L. J. Curtis, D. I. Meyer, and K. M. Terwilliger (Univ. of Michigan, Ann Arbor). p.327-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The reaction $\pi^- + p \rightarrow \Lambda^0 + K^0 + \pi^0$ was investigated in a spark chamber experiment at the Cosmotron. Preliminary results show the Y_1^* resonance at 1385 Mev and are consistent with a spin of $\frac{1}{2}$ for the Y_1^*. (A.G.W.)

9373 THE SPIN OF THE Y_1^* PARTICLE. J. Auman (Northwestern Univ., Evanston, Ill.), M. M. Block, R. Gessaroli, J. Kopelman, S. Ratti, L. Grimellini, T. Kikuchi, L. Lendinara, L. Monari, and E. Harth. p.330-2 of "1962 International Conference on High-Energy Physics at CERN." Geneva European Organization for Nuclear Research, 1962.

The helium bubble chamber was exposed to a stopping K^- beam at the Bevatron, and the reactions $K^- + He^4 \rightarrow Y_1^{*-} + He^3$, $Y_1^{*-} \rightarrow \Lambda^0 + \pi^-$ were studied. Plots of the invariant mass distribution of the Λ^0-π^- system and the pion momentum spectrum indicate the presence of Y_1^*. The angular distribution of the Λ^0 in the rest frame of the Y^* suggests the assignment $J = \frac{3}{2}$. (A.G.W.)

9374 A STUDY OF MANY-PARTICLE RESONANCES. V. A. Belyakov, Wang Yung-chang, V. I. Veksler, et al. (Joint Inst. for Nuclear Research, Dubna, USSR). p.336-41 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The 24-liter propane bubble chamber was exposed in the 7- to 8-Bev π^- beam, and effective masses of the following combinations of charged pions and strange particles were calculated: 2π, 3π, 4π, $K^0\pi$, $K^02\pi$, $K^03\pi$, $\Lambda\pi$, $\Lambda 2\pi$, and $\Lambda 3\pi$. Data indicate existence of the following new many-particle resonances: 4π with $M \cong 1340$ Mev, K^{***} with $M \cong 1650$ Mev, K^{**} with $M \cong 1150$ Mev, and Y^{**} with $M \cong 1760$ Mev. There was some indication of a cascade decay in such many-particle resonances, but this conclusion cannot be considered final. (A.G.W.)

9375 A MEASUREMENT OF THE MAGNETIC MOMENT OF THE Λ^0 HYPERON. W. Kernan (Argonne National Lab., Ill.). T. B. Novey, S. D. Warshaw, and A. Wattenberg. p.347-50 of "International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Polarized Λ^0 produced in the reaction $\pi^- + p^+ \rightarrow \Lambda^0 + K^0$ were allowed to pass through a 200-kG pulsed magnetic field directed parallel or antiparallel to the Λ^0 momentum. The up-down asymmetry of the non-parity conserving $\Lambda^0 + p^+ + \pi^-$ was detected in a diffusion cloud chamber, and the orientation of the plane of decay was used as an indicator for the precession of the magnetic moment vector of the Λ^0. The result of the measurement was $\mu_\Lambda = 0.0 \pm 0.6$ nm where the error is purely statistical. (A.G.W.)

9376 $\bar{P}$-P ANNIHILATIONS AT REST INTO TWO MESONS. R. Armenteros, L. Montanet, D. R. O. Morrison, et al. (CERN, Geneva). p.351-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In an experiment carried out at the CERN proton synchrotron with the Saclay 81-cm hydrogen bubble chamber to study the annihilations in hydrogen of antiprotons at rest, the following reaction rates were found: (1) for $\bar{p} + p \rightarrow \pi^+ + \pi^-$, $(3.95 \pm 0.38) \times 10^{-3}$; (2) for $\bar{p} + p \rightarrow K^+ + K^-$, $(1.31 \pm 0.38) \times 10^{-3}$; (3) for $\bar{p} + p \rightarrow K^0 + \bar{K}^0$, $(0.56 \pm 0.08) \times 10^{-3}$. The percentage of all annihilations leading to the production of $K\bar{K}$ pairs associated with any number of pions was calculated to be $(6.82 \pm 0.25)\%$. (A.G.W.)

9377 PION PRODUCTION BY K^+ MESONS ON HYDROGEN AND DEUTERIUM. J. Fisk (Univ. of California, Los Angeles), H. K. Ticho, D. H. Stork, W. Chinowsky, G. Goldhaber, S. Goldhaber, and T. F. Stubbs. p.358-60 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The processes of single π-meson production of K^+ mesons on hydrogen and deuterium were investigated with the 15-in. bubble chamber. Cross sections for individual processes at 810 Mev/c are tabulated. The dominant reactions were found to be $K^+ + p \rightarrow K^0 + p + \pi^+$ (1) and $K^+ + d \rightarrow K^+ + p + \pi^- + (p)$ (2). Effective mass distribution for pairs of particles in the $K^+p\pi^-$ system showed no significant deviations from phase space. The Dalitz plot for reaction (1) showed strong deviations from a uniform distribution. Possible interpretations of the results are suggested. (A.G.W.)

9378 ON THE K^+-p INTERACTION AT LOW ENERGY. G. Costa, R. L. Gluckstern, and A. H. Zimerman (CERN, Geneva). p.361-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Results of an analysis of the existing information on the K^+-proton scattering interaction are reported. The analysis is confined to the $\underline{I} = 1$ state. (A.G.W.)

9379 DETERMINATION OF THE K^- PARITY. M. M. Block (Northwestern Univ., Evanston, Ill.), L. Lendinara, and L. Monari. p.371-2 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Four independent experiments lead to the conclusion that the ground state spin of the mass 4 hyperfragment is zero, and that, unless an excited state of ${}_\Lambda H^4$ is produced in the reaction $K^- + He^4 \rightarrow {}_\Lambda H^4 + \pi^0$, the K^- meson is pseudoscalar. (A.G.W.)

9380 A STUDY OF THE REACTION $K^+ + p \rightarrow K^0 + \pi^+ + p$. G. B. Chadwick, D. J. Crennell, W. T. Davies, et al. (Oxford Univ.). p.378-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Pictures of 1.45 Bev/c K^+ mesons were taken with the CERN 32-cm hydrogen bubble chamber. Preliminary results presented for 340 events that fit the reaction $K^+ + p \rightarrow K^0 + \pi^+ + p$ include the effective mass distribution for the $K^0\pi^+$ system, a Dalitz plot, and figures showing the projection of the Dalitz plot onto the two kinetic energy axes. (A.G.W.)

9381 BINDING ENERGIES OF HEAVY HYPERNUCLEI. R. G. Ammar, L. Choy, W. Dunn, et al. (Northwestern Univ., Evanston, Ill.). p.382-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The binding energies and decay modes of the identified heavy hyperfragments from 56 π^--mesonic decays of hypernuclei with a mass greater than 5 are tabulated. A compilation of present data averaged with previously published data is also presented. (A.G.W.)

9382 TOTAL CROSS-SECTIONS FOR K^+ AND π^+ MESONS INTERACTION WITH HYDROGEN IN THE MOMENTUM RANGE FROM 2.69 UP TO 4.75 Gev/c. A. S. Vovenko, B. A. Kulakov, M. F. Likhachev, Yu. A. Matulenko, I. A. Savin, E. V. Smirnov, and V. S. Stavinski (Joint Inst. for Nuclear Research, Dubna, USSR). p.385-8 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An attempt to improve the accuracy of measurements of the total cross sections for K^+ interactions with hydrogen is described. Data obtained are compared with results of other groups. Results of measurement of the total cross sections for π^+ interactions with hydrogen are also shown. These results agree with data of other groups. (A.G.W.)

9383 THE PION-HYPERON COUPLINGS, THE $\bar{K}N$ INTERACTIONS, AND THE Y^* RESONANT STATES. R. H. Dalitz (Univ. of Chicago). p.391-401 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Evidence obtained in the past year bearing on the $K\Sigma$ and $K\Lambda$ parities is reviewed; it indicates that both are odd. Meson-theoretical calculations of hyperon-nucleon potentials, and calculations on the Σ^--p reactions are discussed for even $\Sigma\Lambda$ parity and for odd $\Sigma\Lambda$ parity. In the light of these results, the pion-hyperon resonances are considered. It is concluded that the assumption of even $\Sigma\Lambda$ parity can account naturally for the spin dependence of Σ-N forces and for the Σ^--p capture data. Knowledge of the $\bar{K}N$ s-wave scattering parameters obtained from analysis of $\bar{K}^-$-p scattering data in the neighborhood of the 1520-Mev Y_0^{1*} resonance is discussed. (A.G.W.)

9384 THE EVIDENCE OF ODD $K\Sigma N$ PARITY. R. H. Capps (Northwestern Univ., Evanston, Ill.). p.401-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The evidence of odd $K\Sigma N$ parity presented is based on $K^- + p \rightarrow \pi^- + \Sigma^+$ data of Tripp, Watson, and Ferro-Luzzi (Phys. Rev. Letters 8, 175(1962)) and on the four following assumptions: (1) The 395 Mev/c resonance occurs in the $D_{3/2}$, $K^+ + N$ state (amplitude denoted by f_3). (2) The only non-resonant amplitude that is large in the resonance region is produced from the $S_{1/2}$, $K^- + N$ state (amplitude denoted by f_1). (3) In the energy region of the resonance, the relative phase of f_3 and f_1 increases with energy. (4) The proton helicity in the $\Sigma^+ \rightarrow p + \pi^0$ decay is negative. (A.G.W.)

9385 ON K-MESON HYPERON RESONANCES. A. I. Baz, V. G. Vaks, and A. I. Larkin (Kurchatov Inst. of Atomic Energy, Moscow). p.404-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Dalitz and Tuan K-matrix formalism is applied to a phenomenological analysis of strange particle associated production reactions. Data on energy dependence of $\pi^-p \rightarrow \Sigma K$, $\pi^-p \rightarrow \Lambda K$ cross sections near the ΣK threshold suggest the possibility of the existence of a bound state in the ΣK system with $T = 1/2$ and a binding energy $E \sim 30$ Mev. This should result in a resonance in the $\pi^-p \rightarrow \Lambda K$ reaction below the ΣK threshold. (A.G.W.)

9386 EXPERIMENTAL EVIDENCE FOR PION β DECAY. R. B. Bacastow, T. Elioff, R. R. Larsen, C. Wiegand, and T. Ypsilantis (Univ. of California, Berkeley). p.409-10 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An attempt to measure experimentally the pion β-decay branching ratio is described. The basic plan of the experiment is the detection of all the decay products except the neutrino. Preliminary analysis of the data indicates a branching ratio consistent with 10^{-8} (the value previously estimated and predicted by theory). (A.G.W.)

9387 EXPERIMENTAL EVIDENCE FOR STRUCTURE EFFECTS IN THE $\pi^+ \rightarrow e^+ + \nu + \gamma$ DECAY PROCESS. P. Depommier, J. Heintze, A. Mukhin, C. Rubbia, V. Soergel, and K. Winter (CERN, Geneva). p.414-15 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An experiment intended to detect high-energy electron-γ pairs emitted in opposite directions from the $\pi^+ \rightarrow e^+ + \nu + \gamma$ decay process was performed. It is shown that the number of such events recorded (8 ± 2) indicates the presence of a structure in the radiative π^+ decay. (A.G.W.)

9388 A MEASUREMENT OF THE μ^+ LIFETIME. F. J. M. Farley, T. Massam, T. Muller, and A. Zichichi (CERN, Geneva). p.415-17 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The muon lifetime was measured by the standard technique of stopping π^+ in a carbon absorber and recording the time distribution of positrons from the $\pi^+ \rightarrow \mu^+ \rightarrow e^+$ decay chain. The experiment was designed to eliminate systematic errors due to beam structure to a greater extent than in previous measurements. Preliminary results give a value of 2198 ± 1 nsec. (A.G.W.)

9389 COMPARISON OF THE LIFETIMES OF POSITIVE AND NEGATIVE MUONS IN LIQUID HYDROGEN. E. W. Anderson, E. Bleser, S. Meyer, J. Rosen, J. Rothberg, and I. T. Wang (Columbia Univ., New York). p.417-18 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Measurement of μ^+ and μ^- lifetimes in very pure hydrogen gave a result of $\tau^+/\tau^- = 1.000$ with an uncertainty of 0.2%. (A.G.W.)

9390 μ^- CAPTURE IN HYDROGEN. R. H. Hildebrand (Argonne National Lab., Ill. and Univ. of Chicago) and J. H. Doede. p.418-20 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The rate of the basic μ^- capture process $\mu^- + p \rightarrow n + \nu$ in liquid hydrogen was measured in a hydrogen bubble chamber. The result was $\Lambda = 434 \pm 100$ sec^{-1}. An upper limit to the capture rate obtained by identifying capture events simply by the non-decay of the μ's was $\Lambda \geq 613 \pm 50$ sec^{-1}. These results are compared with the "universal" V – A capture theory and the V + A variant of the theory. (A.G.W.)

9391 DETERMINATION OF THE μ^- TOTAL CAPTURE RATE IN LIQUID HYDROGEN. E. Bertolini, A. Citron, G. Gialanella, S. Focardi, A. Mukhin, C. Rubbia, and S. Saporetti (Istituto Nazionale di Fisica Nucleare, Rome and Bologna and CERN, Geneva). p.421-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The total μ^- capture rate in liquid hydrogen was measured in a hydrogen bubble chamber. The result was R_{H_2} = 420 ± 75 sec^{-1}. (A.G.W.)

9392 SEARCH FOR THE $\mu \rightarrow 3e$ DECAY. A. I. Alikhanov, A. I. Babaev, M. Ya. Balats, V. S. Kaftanov, L. G. Landsberg, V. A. Lyubimov, and Yu. V. Obukhov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.423-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An experimental set-up in which an Al 6-gap cylindrical spark chamber was used to record electron tracks from $\mu \rightarrow 3e$ decay is described. During a ~140-hr run, 1.54 × 10^9 mesons were stopped in the target counter. No cases were found which could be considered $\mu \rightarrow 3e$ decays according to the criteria used. (A.G.W.)

9393 MEASUREMENT OF THE DECAY PARAMETERS FOR THE Λ^0 PARTICLE. J. W. Cronin and O. E. Overseth (Princeton Univ., N. J.). p.453-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In an experiment designed to measure the amplitudes in the decay $\Lambda^0 \rightarrow \pi^- + p$, Λ^0's were produced in a spark chamber array and the polarization of the decay protons was observed by their scattering in large carbon plates. The following conclusions were reached: (1) that α (the up-down asymmetry parameter) = −0.62 ± 0.07; (2) that the phase between the s-wave and p-wave amplitudes is +15° ± 20° in agreement with +7° expected on the basis of time reversal invariance; (3) that $p/s = 0.36^{+0.5}_{-0.3}$. (A.G.W.)

9394 ON RADIATIVE MUON CAPTURE. G. Conforto, M. Conversi, and L. Di Lella (CERN, Geneva). p.427-30 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In a search for the hitherto unobserved process $\mu^- + N \rightarrow N + \nu + \gamma$, 90-Mev μ^- were stopped in the steel plates of a spark chamber, and γ rays with energy >60 Mev were recorded. The conditions considered as identifying the process searched for were met by 9.5 ± 3.8 events. From this the branching ratio relative to ordinary μ^- capture was found to be ~10^{-4}. (A.G.W.)

9395 THE β DECAY OF THE Λ HYPERON. R. P. Ely (Univ. of California, Berkeley), G. Gidal, L. Oswald, W. Singleton, W. M. Powell, F. W. Bullock, G. E. Kalmus, C. Henderson, and F. R. Stannard. p.445-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The β decay of Λ hyperons, $\Lambda \rightarrow p + e^- + \bar{\nu}$, was studied from Λ's produced by stopping K^- mesons in the Berkeley 30-in. propane chamber. The β decay rate was calculated from events selected on the basis of one of the following criteria: (1) δ rays too large for a π, (2) the e^- stopped in the chamber, or (3) the negative track too long for the π required from a Λ. Consideration of all three categories gave a branching ratio of β decays to mesonic decays of (1.0 ± 0.3) × 10^{-3}. (A.G.W.)

9396 THREE-BODY LEPTONIC DECAYS OF K_1^0 AND K_2^0, $\Delta I = 1/2$ RULE AND $\Delta S = \Delta Q$ RULE. G. Alexander, S. P. Almeida, and F. S. Crawford (Univ. of California, Berkeley). p.448-51 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

K^0 mesons were produced through $\pi^- + p \rightarrow \Lambda + K^0$ in the 72-in. Alvarez chamber. The number of leptonic decays observed indicates that $\Delta I = 1/2$ does not hold for K_2^0 three-body leptonic decays. It is suggested that $\Delta S = \Delta Q$ is at least partly responsible. Evidence was also found that the $\Delta I = 1/2$ rule fails for decay of K_2^0 into $\pi^+\pi^-\pi^0$. The total K_2 decay rate was calculated to be (14.8 ± 4.1) × 10^6 sec^{-1} and the lifetime, $6.8^{+2.6}_{-1.5} \times 10^{-8}$ sec. Results are compared with results of other experiments. (A.G.W.)

9397 INVESTIGATION OF DECAY PROPERTIES OF K_2^0-MESONS. M. H. Anikina, M. S. Zhuravleva, D. M. Kotliarevskii, et al. (Inst. of Physics, Georgian Academy of Science, USSR and Joint Inst. for Nuclear Research, Dubna, USSR). p.452-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In a cloud chamber exposed to a K_2^0 beam, 4100 "usual" K_2^0 decays were observed. The value of the branching ratio of 3-π^0 decay to charge decay obtained was 0.38 ± 0.07. Implications of the results with respect to $\Delta I = 1/2$ are considered; data to date are inconclusive. (A.G.W.)

9398 OBSERVATION OF THE DECAY $\Sigma^- \rightarrow \Lambda^0 + e^- + \nu$. L. Grimellini, (Universita, Bologna), T. Kikuchi, L. Lendinara, L. Monari, and M. M. Block. p.457 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The He bubble chamber was exposed to a stopping beam of K^- mesons. In scanning, an event interpreted as the ordinary β decay ($\Delta S = 0$ transition) of the Σ^- was observed, i.e., $\Sigma^- \rightarrow e^- + \Lambda^0 + \nu$, where the Λ^0 decay was seen in the chamber. A photo is shown. (A.G.W.)

9399 LIFETIME OF THE HYPERNUCLEUS $_{\Lambda}H^3$. M. M. Block (Northwestern Univ., Evanston, Ill.), C. Meltzer, S. Ratti, L. Grimellini, T. Kikuchi, L. Lendinara, and L. Monari. p.458-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The He bubble chamber, in a 14000-gauss field, was exposed to a stopping K^- beam. From events satisfying the criteria set up for the reaction $K^- + He^4 \rightarrow \pi^- + p + {}_{\Lambda}H^3$, the mean lifetime of the $_{\Lambda}H^3$ was found to be $(1.23^{+0.21}_{-0.20}) \times 10^{-10}$ sec. It is suggested that the data are compatible with the anti-parallel spin assignment, $J = 1/2$, for $_{\Lambda}H^3$. (A.G.W.)

9400 DETERMINATION OF THE $_{\Lambda}H^4$ LIFETIME. N. Crayton, D. H. Davis, R. Levi Setti, et al. (Univ. of Chicago). p.460-2 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The $_{\Lambda}H^4$ lifetime was measured by observation of both decays at rest and in flight by the mode $_{\Lambda}H^4 \rightarrow He^4 + \pi^-$. In an emulsion stack exposed to a stopping K^- beam, 9 decays in flight and 43 decays at rest were found. From these the maximum likelihood estimate of the $_{\Lambda}H^4$ mean lifetime was determined to be $(1.18^{+0.65}_{-0.30}) \times 10^{-10}$ sec. (A.G.W.)

9401 PHOTOPRODUCTION OF MUON PAIRS IN CARBON. A. Alberigi-Quaranta, M. De Pretis, G. Marini, A. Odian, G. Stoppini, and L. Tau (Laboratori Nazionali di Frascati, Rome). p.469-73 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A 1000-Mev bremsstrahlung beam was collimated to a 2-cm-dia spot on a carbon target 5 cm long. The counter arrangement used to detect μ^+ emitted at 10° on one side of the photon beam and μ^- at 10° on the opposite side is described. Results are shown in the form of ratios of the absolute experimental cross sections for muon pairs photoproduced in carbon to the corresponding theoretical cross sections. Differences from unity in the ratios shown are hardly significant; the overall average is 1.00 ± 0.05. It is

concluded that no anomalous behavior was observed. (A.G.W.)

9402 HYPERFINE STRUCTURE OF MUONIUM. J. Bailey, W. Cleland, V. W. Hughes, R. Prepost, and K. Ziock (Yale Univ., New Haven, Conn.). p.473-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A precision measurement of the hyperfine structure splitting of muonium in its ground $1^2S_{½}$ state was made by a special microwave spectroscopy technique (Ziock, K. et al., Phys. Rev. Letters 8: 103(1962)). The result, 4461.3 ± 2.2 Mc/sec, agreed with a value of 4463.13 ± 0.10 Mc/sec calculated from the quantum electrodynamic theory of the muon, electron, and photon fields. (A.G.W.)

9403 (g-2) AND ITS CONSEQUENCES. G. Charpak, F. J. M. Farley, R. L. Garwin, T. Muller, J. C. Sens, and A. Zichichi (CERN, Geneva). p.476-80 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The anomalous magnetic moment of the muon was measured to an accuracy of ±0.4%. The main problems faced in improving the accuracy from the previous level of 2% are described. The final result is ½(g-2) = 0.001162 ± 0.000005 to be compared with the theoretical value of ½(g-2) = 0.001165. Some consequences of the result with respect to the validity of quantum electrodynamics and vacuum polarization effects in muon physics are discussed briefly. (A.G.W.)

9404 MESONIC ATOM PROCESSES IN HYDROGEN AND DEUTERIUM AND THE MUON CATALYSIS OF FUSION REACTIONS. V. P. Dzhelepov, M. Friml, S. S. Gershtejn, Yu. V. Katyshev, V. I. Moskalev, and P. F. Yermolov (Joint Inst. for Nuclear Research, Dubna, USSR). p.484-90 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In experiments carried out with a high-pressure diffusion chamber, the following measurements were made: the rate of the muon transfer $p\mu + d \rightarrow d\mu + p$ from the proton to the deuteron; the rates of formation of the $pp\mu$, $pd\mu$, and $dd\mu$ ions; the cross section of elastic scattering of $p\mu$ mesonic atoms by protons; and the rates of the muon transfer from the proton and the deuteron to complex nuclei. The conditions of experiments and the results are tabulated. It is concluded that the majority of the quantitative properties of mesonic atom processes measured experimentally is in satisfactory agreement with theoretical predictions and confirms the correctness of the mechanism suggested theoretically. (A.G.W.)

9405 ELECTRODYNAMICAL CROSS-SECTIONS AT HIGH ENERGY. P. Budini and G. Furlan (Università, Trieste, Italy and Istituto Nazionale di Fisica Nucleare, Trieste, Italy). p.490-2 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

It has been shown previously that the total cross section for positron-electron annihilation into photons can be written in the form $\sigma_T = \sigma_0(1 + \sigma_T)$ where σ_0 is the Born approximation. As the total energy E goes to infinity the leading term of δ_T is proportional to $(\alpha/\pi)\ln^2(2E/m)$. This result is generalized. Several assumptions are made on the basis of which an upper limit to the asymptotic total cross section for annihilation in photons is given. (A.G.W.)

9406 ON NEW POSSIBILITIES FOR CHECKING THE ELECTROMAGNETIC PROPERTIES OF ELECTRONS AND MUONS. E. D. Zhizhin and V. V. Solov'ev (Inst of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.493-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

It has been previously shown (Kobzarev and Okun, Zhur. Eksptl'. i Teoret. Fiz., in press) that the small width of the pion decays of ω^0 and η^0 mesons leads to the possibility of the radiative decays being essential. It can be supposed that conversion decays for the same reason will be sufficiently effective as well. Possible ways of using these decays for investigating the electromagnetic properties of electrons and muons are discussed. (A.G.W.)

9407 PHOTOPRODUCTION OF NEUTRINOS IN NUCLEAR COULOMB FIELD. G. Marx and J. Németh (Eötvös Loránd Univ., Budapest). p.498-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Possible processes producing neutrinos in a degenerated plasma are considered. It is concluded that at about $10^{9.5}$K the reactions $\gamma + e^- \rightarrow e^- + \nu + \bar{\nu}$, $\gamma + Z \rightarrow Z + \nu + \bar{\nu}$, and $\gamma + e^- + Z \rightarrow Z + e^- + \nu + \bar{\nu}$ can be competing processes. Above $2 \times 10^{9.5}$K the process $\gamma + Z \rightarrow Z + e^- + e^+$, $e^- + e^+ \rightarrow \nu + \bar{\nu}$ will be dominant. (A.G.W.)

9408 TOPICS ON COMPLEX ANGULAR MOMENTA. T. Regge (Università, Turin). p.503-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The general validity of potential scattering as a model in considering the properties of partial wave amplitudes as functions of angular momentum is questioned. The procedure used by Blankenbecler et al., to reconstruct the scattering amplitude out of the Mandelstam representation, unitarity, and the first Born approximation is discussed. An integral representation for the Jost function F(l,k) is postulated. (A.G.W.)

9409 CALCULATION OF REGGE POLES. C. Lovelace and D. Masson (Imperial Coll., London). p.510-12 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A new bound-state method was used to calculate positions of Regge poles. It applies to any system that can be described by a separable differential equation. First, an asymptotic series in k^{-1} for all the Regge poles is obtained; then these asymptotic series are summed by converting them to continued fractions. Two defects in a previous analysis of pion-nucleon diffraction scattering using a Regge pole formula and a conformal mapping technique are discussed. (A.G.W.)

9410 REGGE POLES AS CONSEQUENCES OF ANALYTICITY AND UNITARITY. S. Mandelstam (Univ. of Birmingham, Eng.). p.513-14 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A proof of the following assumption regarding Regge poles in relativistic scattering amplitudes is reported: the solution of the equations obtained from analyticity and elastic unitarity have the Regge asymptotic behavior, so that his results may be applied in treating these equations. (A.G.W.)

9411 PARTIAL WAVES WITH COMPLEX ANGULAR MOMENTA AND THEIR MOVING SINGULARITIES. V. N. Gribov (Ioffe Physico-Technical Inst., Academy of Sciences, Leningrad). p.515-21 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Proof of the following results is given: (1) The Mandelstam representation permits one to introduce uniquely the amplitudes with complex angular momenta l $f_l(t)$ which coincide with the usual partial waves at even and odd l, so that f_l has no singularities in the semiplane Re $l > l_0$, is bounded in this semiplane, and satisfies the generalized unitarity condition. (2) The asymptotics of the high-energy scattering is determined by singularities of $f_l(t)$ in the region Re $l > l_0$. (3) The investigation of the properties of $f_l(t)$ as a function of l and t simultaneously permits one, taking into account only the 2-particle states in the unitarity condition, to prove that the only singularities of $f_l(t)$ of the second class are poles. (4) If we assume that the statement made will hold when taking into account the many-particle channels, there may exist only two types of the asymptotic behavior of the high-energy scattering, namely, (a) the asymptotics determined by the moving poles, (b) the asymptotics determined by the singularities whose position does not depend on t. (A.G.W.)

9412 LIMITATION ON THE RATE OF DECREASE OF AMPLITUDES IN VARIOUS PROCESSES. V. N. Gribov (Ioffe Physico-Technical Inst., Academy of Sciences, Leningrad) and I. Ya. Pomeranchuk. p.522-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

It is shown that in relativistic theory the partial wave amplitudes $f_l(t)$ have for any value of t singularities when Re $l \geq -1$ and accordingly that the amplitude $A(s,t)$ cannot decrease faster than $1/s$ whatever the value of t. This conclusion is valid for the amplitude for any 2-particle process. (A.G.W.)

9413 STRONG INTERACTION THEORY WITHOUT ELEMENTARY PARTICLES. G. F. Chew (Univ. of California, Berkeley and CERN, Geneva). p.525-30 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

It has been proposed that an understanding of strong interactions may be based on S-matrix assumptions involving no arbitrary parameters. The postulates on which this proposal is based and the deficiencies of current techniques for investigating these postulates are considered. In particular the question is raised: How can one construct the strong-interaction S-matrix without some a priori assumption as to its dimensionality? Some calculations that support the author's belief that an answer will be found are discussed. (A.G.W.)

9414 APPLICATIONS OF REGGE POLES. M. Gell-Mann (California Inst. of Tech., Pasadena). p.533-42 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Work done to date in connection with the Regge pole hypothesis is summarized. The following results are discussed in more detail: (1) a restatement of the "reggeizing" rules; (2) the general application of the "reggeizing" rules to the π-π, π-N, and N-N channels; (3) the role of the signature in producing symmetrics at high energies; (4) the explanation of why the "ghost" is not present along the Pomeranchuk trajectory, even if $\alpha_p(t)$ passes through zero at negative t. A comment on the case of anomalous threshold, with particular reference to nuclei, is appended. (A.G.W.)

9415 FERMION REGGE-POLES AND ASYMPTOTIC BEHAVIOR OF MESON-NUCLEON LARGE-ANGLE SCATTERING. V. N. Gribov (Ioffe Physico-Technical Inst., Academy of Sciences, Leningrad). p.547-51 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

It is shown that the Regge-pole trajectories describing the fermion family possess a number of properties substantially different from those previously discussed and shown by non-relativistic quantum mechanics. Specifically, the poles of the scattering amplitudes $f_+^j(u)$ and $f_-^j(u)$ (referring to states with angular momentum j and parity $(-1)^{j+1/2}$) must coincide when the squared energy in the center-of-mass system u tends to zero, and become complex conjugate for $u < 0$. This leads to an absolutely characteristic behavior of meson-nucleon elastic scattering amplitudes in the region of angles close to 180°. Formulas defining this behavior are given. (A.G.W.)

9416 REGGE POLES IN THE N-N AND $\bar{N}$-N SCATTERING AMPLITUDES. V. N. Gribov (Ioffe Physico-Technical Inst., Academy of Sciences, Leningrad) and D. V. Volkov. p.552-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The spin structure of the N-N and $\bar{N}$-N scattering amplitudes appearing if Regge poles with other quantum numbers are taken into account is discussed briefly. (A.G.W.)

9417 REGGE-POLES AND HIGH ENERGY SCATTERING. G. Domokos (Joint Inst. for Nuclear Research, Dubna, USSR). p.553-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Some applications of the "Regge hypothesis" in analysis of high-energy scattering are pointed out. A method of obtaining an approximate analytic expression for the vacuum trajectory is described. (A.G.W.)

9418 PARTIAL WAVE ANALYSIS AND THE HIGH ENERGY BEHAVIOR OF MANY-PARTICLES AMPLITUDES. K. A. Ter-Martirosyan (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.556-60 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A simple method of relativistic partial wave analysis of general many-particle amplitudes is proposed. The expansions thus obtained are used to analyze the asymptotic behavior of the amplitudes of inelastic processes on the basis of the Regge (Nuovo cimento, 14: 951(1959)) and Gribov (Zhur. Eksptl'. i Teoret. Fiz., 41: 1962(1961); 41: 667 (1961)) method. (auth)

9419 THEORY OF HIGH-ENERGY SCATTERING AND MULTIPLE PRODUCTION. D. Amati, S. Fubini, and A. Stanghellini (CERN, Geneva). p.560-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Predictions obtained by means of a model for high-energy interactions are summarized. The model was suggested by the structure of the strip approximation to the Mandelstam representation and can be understood as a generalization to very high energy of the peripheral model. The basic idea is that the main contributions to multiple production are given by a combination of a large number of low-energy processes. (A.G.W.)

9420 THE PERIPHERAL INTERACTION EXPANSION. R. E. Cutkosky (NORDITA, Copenhagen). p.565-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A method of constructing a complete perturbation expansion is summarized. The renormalized masses and coupling constants are put in from the beginning, as are the scattering amplitudes in certain pre-selected channels. From the higher terms of the expansion the contributions that reproduce these amplitudes must be subtracted. The procedure can be generalized in several ways. (A.G.W.)

9421 LIMITATIONS IMPOSED BY UNITARITY ON THE IMAGINARY PART OF A SCATTERING AMPLITUDE AND CONSEQUENCES OF ITS HIGH-ENERGY BEHAVIOUR. A. Martin (CERN, Geneva). p.566-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An upper bound of $|\mathrm{Im}\, f|$ in the physical region and a lower bound of $\mathrm{Im}\, f$ in that part of the unphysical region for which $t = -2k^2(1 - \cos\theta) > 0$ (θ is the scattering angle and k the center-of-mass momentum), when the Legendre expansion still converges, are given. From these limits conclusions are drawn concerning the high-energy behavior of the imaginary part of the scattering amplitude and the total cross section. (A.G.W.)

9422 FIELD-THEORETICAL MODELS OF INELASTIC NUCLEON-NUCLEON COLLISIONS AT SUPERHIGH ENERGY. Z. Koba and A. Krzywicki (Inst. of Nuclear Physics, Polish Academy of Sciences, Warsaw). p.568-70 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Certain assumptions and predictions of two field-theoretical models are compared with available experimental data on cosmic ray jets (>10^2 Bev). The two models discussed are the one-pion-exchange model and a more refined model describing a high-energy nucleon-nucleon collision in terms of a chain of nucleon-pion and pion-pion collisions at the resonance region. (A.G.W.)

9423 HIGH ENERGY CHARGE EXCHANGE. F. Steinrisser, B. Hahn, and W. Lindt (Université de Fribourg, Switzerland). p.573-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A $CBrF_3$ bubble chamber was exposed to a practically pure beam of 25-Bev protons. Photographs were scanned for tracks typical of charge exchange processes of the types (1) $p + n \rightarrow n + p$ and (2) $p + n \rightarrow n + p +$ neutrals. Figures show information on the laboratory angular distribution and the recoil energy involved in reaction (1). Cross sections of (50 ± 15) μb and (80 ± 20) μb are given for reactions (1) and (2) respectively. Results are compared with theoretical calculations. (A.G.W.)

9424 EXPERIMENTS ON PROTON-PROTON SCATTERING BETWEEN 8 AND 26 Gev. A. N. Diddens, E. Lillethun, G. Manning, A. E. Taylor, T. G. Walker, and A. M. Wetherell (CERN, Geneva). p.576-82 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Measurements of proton-proton elastic and near-elastic scattering were made by two methods. In one method CH_2 and C targets were used in the internal beam of the proton synchrotron; in the other an external proton beam was scattered from a liquid H_2 target. Cross sections obtained by both methods are tabulated. Elastic scattering data showed a definite shrinking of the width of the diffraction pattern as proton momentum increased. The double-bump structure previously observed in inelastic p-p scattering spectra was again evident. The two peaks correspond to π-p resonances with masses 1.51 ± 0.01 and 1.69 ± 0.01 Bev, respectively. (A.G.W.)

9425 ON THE DIFFERENTIAL ELASTIC p-p SCATTERING AT 6 Gev AND 10 Gev. B. Bekker, L. Kirillova, A. Nomofilov, V. Nikitin, V. Pantuev, V. Sviridov, L. Strunov, M. Khachaturian, and M. Shafranova (Joint Inst. for Nuclear Research, Dubna, USSR). p.582-4 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A thin polyethylene target was used in the internal proton beam of the synchrophosotron to measure the differential cross sections of elastic p-p scattering at 6 and 10 Bev. From the data, the universal Regge function L(t) was calculated. Values of the parameter λ in the linear approximation of the function $L(t) = 1 + \lambda t$ in the formula for the differential cross section of elastic scattering at high energies were found to be $\lambda_6 = 0.032 \pm 0.008$ and $\lambda_{10} = 0.029 \pm 0.008$. (A.G.W.)

9426 MEASUREMENT OF HIGH ENERGY POSITIVE PION-PROTON ELASTIC SCATTERING AT 180°. B. A. Kulakov, M. F. Lykhachev, A. L. Lyubimov, Yu. A. Matulenko, I. A. Savin, and V. S. Stavinski (Joint Inst. for Nuclear Research, Dubna, USSR). p.584-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Measurements of the differential cross sections for the elastic scattering of π^+ mesons on protons at 180° gave values of 0.92 ± 0.47 mb/sterad and 0.38 ± 0.24 mb/sterad for π^+ momenta of 3.14 and 4.6 Bev/c, respectively. (A.G.W.)

9427 CHARGE EXCHANGE CROSS SECTION IN π-p COLLISIONS AT 6 AND 18 Gev/c. G. Bellini, E. Fiorini, and A. Orkin-Lecourtois (Ecole Polytechnique, Paris and Istituto Nazionale di Fisica Nucleare, Milan). p.586-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A one-meter bubble chamber filled with a propane-Freon mixture was exposed to 6- and 18-Bev/c π^- beams. Analysis of the data obtained resulted in the following upper limits for the elastic charge exchange cross section in hydrogen: <56 μb at 6 Bev/c and <95 μb at 18 Bev/c (both with 90% confidence level). The cross section for V^0V^0 production in zero-prong interactions in hydrogen at 6 Bev/c was calculated to be (0.62 ± 0.12) mb. (A.G.W.)

9428 LARGE ANGLE SCATTERING OF PIONS ON NUCLEONS. Yu. D. Bayukov, N. G. Birger, G. A. Leksin, D. A. Suchkov, Ya. Ya. Shalamov, and V. A. Shebanov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.588-91 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Stereophotographs of interactions of a 2.8-Bev/c π^- beam in a bubble chamber filled with freon or a propane-xenon mixture were analyzed. The angular dependence of the differential cross section for elastic scattering of pions on neutrons in the angle interval from 10° to 180° in the center-of-mass system is shown. The elastic charge exchange reaction $\pi^- + p \rightarrow \pi^0 + n$ was also studied. The cross section was found to be $\lesssim 0.01$ mb/sterad. Results are compared with theoretical estimates. (A.G.W.)

9429 HIGH-ENERGY ELASTIC PION-PROTON SCATTERING BETWEEN 1.5 AND 5 Gev/c. L. W. Jones (Univ. of Michigan, Ann Arbor), Kwan W. Lai, M. L. Perl, S. Ting, V. Cook, B. Cork, and W. Holley. p.591-6 of

"1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Three sets of experiments were done at the Lawrence Radiation Lab. bevatron. The first employed scintillation chambers to study π^--p elastic scattering from 10 to 120° (lab.) at incident pion momenta of 1.51, 2.01, and 2.53 Bev/c. The second employed spark chambers to study π^+-p elastic scattering at 1.5, 2.0, and 2.5 Bev/c over an angular range extending to somewhat smaller forward angles. The third employed an arrangement of thin-plate spark chambers to measure elastic π^--p scattering at 3.0, 4.0, and 5.0 Bev/c over angles from <4 to >90° (lab.). Data from all three experiments are summarized. The most prominent feature of the data at all energies studied is the diffraction peak at small angles. Possible interpretations of large-angle scattering are suggested. (A.G.W.)

9430 A STUDY OF TWO-PRONG EVENTS PRODUCED BY 10 Gev/c π^- IN HYDROGEN. P. Fleury, G. Kayas, F. Muller, and C. Pelletier (Ecole Polytechnique, Paris). p.597-602 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The Saclay 81-cm hydrogen bubble chamber was exposed to a 10-Bev π^- beam. From the pictures taken, 1044 two-prong events were selected for study. The total cross section for elastic events was found to be 4.1 ± 0.3 mb. Inelastic events were divided into two types, and cross sections of (0.85 ± 0.12) mb for $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ and (0.47 ± 0.09) mb for $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ were obtained. The invariant mass distribution of the $\pi^-\pi^+$ system is shown. A peak at about 0.750 Bev is identified with the ρ^0 meson, and the mechanism of ρ-meson production is discussed. It is suggested that the accumulation of mass values below 0.650 Bev might be due to charged pions from the disintegration of an ω^0 meson. (A.G.W.)

9431 STUDY OF EFFECTIVE MASS BETWEEN π^+ AND π^- IN TWO PRONG STARS WITH AND WITHOUT π^0, PRODUCED BY π^- OF 6 Gev/c. J. Hennessy (Ecole Polytechnique, Paris), J. J. Veillet, M. Di Corato, and P. Negri. p.603-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A bubble chamber filled with a propane-freon mixture was used to study the mass distribution of the $\pi^+\pi^-$ group in the reactions $\pi^- + p \rightarrow \pi^+ + \pi^- + N$ and $\pi^- + p \rightarrow \pi^+ + \pi^- N + n\pi^0$ for a π^- incident momentum of 6 Bev/c. The mass spectrum of $\pi^+\pi^-$ without π^0 presents very few low-mass events and a well marked peak at the ρ mass. It has also at ~1200 Mev a peak whose interpretation is not yet clear. The mass spectrum of $\pi^+\pi^-$ with π^0 shows many low-mass events, and the ρ does not appear clearly. (A.G.W.)

9432 PERIPHERAL EFFECTS OF 16 Gev/c NEGATIVE PIONS AND THE π-π CROSS SECTION. D. R. O. Morrison (CERN, Geneva). p.606-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Measurements were made on 2-prong events produced by 16-Bev/c π^- in a hydrogen bubble chamber. It is shown that in high-energy π^--p interactions there exists a class of events in which the incident pion appears to be diffraction scattered. These may be interpreted as diffraction scattering on a virtual pion or in terms of the exchange of a Pomeranchuk pole. With the former explanation a total π-π cross section of 16 mb can be deduced. A comparison is made between this process in π-p and p-p interactions. (A.G.W.)

9433 RESULTS ON PERIPHERAL PION-NUCLEON INTERACTIONS AT 12 AND 17 Gev/c. D. O. Caldwell, E. Bleuler, B. Elsner, L. W. Jones, and B. Zacharov (CERN, Geneva). p.610-12 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Those interactions of 12- and 17-Bev/c π^- in a CH target in which two charged particles emerged in the forward direction with nearly all of the incident energy were observed in a search for information about shortlived neutral particles which decay into a $\pi^+\pi^-$ or K^+K^- pair. In this experiment there was no way of knowing whether the observed particles were π's or K's. Results of making two assumptions as to the masses of the observed particles, that they are either pion pairs or kaon pairs, are shown. (A.G.W.)

9434 PRELIMINARY RESULTS ON "GLANCING" COLLISIONS OF HIGH-ENERGY NEGATIVE PIONS. G. Bellini, E. Fiorini, A. J. Herz, P. Negri, and S. Ratti (Universita, Milan and Istituto Nazionale di Fisica Nucleare, Milan). p.613-16 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Preliminary results on "glancing" collisions of 6.1- and 18.1-Bev/c π^- on charged and neutral targets in a bubble chamber filled with a propane-freon mixture are reported. Some evidence was found for occurrence of diffraction dissociation. (A.G.W.)

9435 INELASTIC π^--NUCLEON INTERACTIONS AT 7 Gev. K. Lanius. p.617-20 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The main results of a study of π^--N interactions in which emulsion stacks were exposed to π^- beams of 6.8, 7.3, and 7.5 Bev are summarized. Data presented include momentum distributions in the lab. system and the center-of-mass system for protons emitted in 2-, 3-, and 4-prong events, angular distribution of protons in the center-of-mass system, proton transverse momentum distribution, and distribution of the inelasticity K (total energy of all produced particles divided by the energy of the primary) of the pion-nucleon interactions. The data suggest the existence of at least two different types of pion-nucleon interactions at 7 Bev corresponding to $K \lesssim 0.5$ and $K > 0.5$, respectively. (A.G.W.)

9436 ON THE ROLE OF BARYON EXCITATION IN VERY HIGH-ENERGY COLLISIONS. B. Peters (Univ. of Copenhagen). p.623-32 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

At all energies above a few Bev, the probability that two nucleons emerge from a collision in one of the excited baryon states (with or without change of strangeness number) seems to be much higher than the probability that one or both emerge in a nucleon ground state. As a result, the secondary particles fall naturally into two categories: (1) The particles created in the collision center (pionization process); their energy remains constant in the center-of-mass system, but their number increases in proportion to the energy available for particle creation. (2) Pions created at some distance from the collision center by decay of excited baryons (or hyperons); their number remains constant but the laboratory energy of those emitted by the incident baryon increases approximately linearly with the primary energy. (A.G.W.)

9437 OBSERVATION ON EXTREMELY HIGH-ENERGY NUCLEAR EVENTS WITH EMULSION CHAM-

BERS. M. Akashi, K. Shimizu, Z. Watanabe, et al. (Univ. of Hirosaki, Japan). p.633-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Large emulsion chambers covering a total area of 18 m^2 were exposed to cosmic rays for about one year. One thousand γ rays with energies higher than 10^{12} ev and 60 families ($10^{13\sim15}$ ev) were observed. The production spectrum of π^0 mesons in individual events is shown. The fact that the spectrum changes with increasing primary energy appears to indicate that the mechanism of meson production changes. Possible interpretations of the change are suggested. (A.G.W.)

9438 HIGH ENERGY INTERACTIONS OBSERVED IN THE REGION OF 10^{14} ev. I. Miura and Y. Tanaka (Tokyo Univ.). p.637-8 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A lattice array of about 25,000 neon-filled tubes extended over an area of 12 m^2 was used to study the lateral structure of high-energy cascade showers. Showers of very steep structure with energies $>10^{13}$ ev were noted. Observations appear to suggest a possible change of the characteristics of the nuclear interaction in the energy range above 10^{14} ev. (A.G.W.)

9439 NEUTRINOS AND THE COSMIC RAY INTENSITY AT GREAT DEPTHS. B. Pontecorvo (Joint Inst. for Nuclear Research, Dubna, USSR) and A. E. Chudakov. p.638-40 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An analysis of recent data on the intensity of cosmic rays at great depths leads to the following conclusions: (1) The energy density of high-energy neutrinos ($E_\nu \gtrsim 1$ Bev) in the universe is at least less by three orders of magnitude than the total energy density of nucleons. (2) The neutrino-nucleon scattering cross section ($E_\nu \gtrsim 1$ Bev) is smaller than 10^{-34} cm^2. (auth)

9440 CHARACTERISTICS OF NUCLEAR INTERACTIONS OF PROTONS AND PIONS IN CARBON AT ENERGIES OF ABOUT 50 Gev. Siddheshwar Lal, R. Raghavan, B. V. Sreekantan, T. N. Rangaswanny, A. Subramanian, and S. D. Verma (Tata Inst. of Fundamental Research, Bombay). p.641-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A multiplate cloud chamber was used to study nuclear interactions in carbon produced by protons and pions of the cosmic radiation at energies of about 50 Bev. A group of events was observed which apparently resulted in no charge exchange, with one outgoing charged pion carrying away 80-90% of the incident energy. A tentative interpretation of these events is suggested. (A.G.W.)

9441 MULTI-FIRE-BALL MODEL OF MULTIPLE MESON PRODUCTION. S. Hayakawa (Nagoya Univ., Japan). p.643-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

According to the proposed multi-fire-ball model, the number of fire-balls is not always limited to two but may be four or more. Experimental evidence in support of this model is cited. Once the multi-fire-ball model is assumed, the following features appear: (1) The angular distribution in the rest system of a fire-ball is not isotropic. (2) The number of secondary particles emitted from a fire-ball is essentially independent of any other parameters. (3) The speed of a fire-ball seems to be limited to a few discrete values. (4) The inelasticity of a collision decreases with increasing energy until it reaches a threshold for producing more fire-balls. (A.G.W.)

9442 DYNAMICAL MODELS INCORPORATING HIGHER SYMMETRIES. R. E. Cutkosky, J. Kalckar, and P. Tarjanne (NORDITA, Copenhagen). p.653-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

It is shown that it is self-consistent to assume that the baryons belong to the fundamental (n-dimensional) representation, and that the pseudoscalar and vector mesons belong to the regular representation. Such calculations can also be applied to the octet version of SU_3 and other groups. (A.G.W.)

9443 RENORMALIZABLE COMPOSITE MODEL OF ELEMENTARY PARTICLES. Y. Miyamoto (Tokyo Univ.). p.655-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A renormalizable theory is presented in which it is assumed that π, ω, ρ, ζ, etc., are bosons which are bound states of baryons and antibaryons and that the ζ vector meson is the principal gluon that binds the baryons and antibaryons. Results of a calculation of the coupling constant of the ζ meson are given. (A.G.W.)

9444 SYMMETRY OF STRONGLY INTERACTING SYSTEMS WITH ZERO HYPERCHARGE. A. M. Baldin and A. A. Komar (Joint Inst. for Nuclear Research, Dubna, USSR). p.657-60 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Presently available experimental data on the π, η, ζ, ρ, and ω mesons, y_1^* and y_0^* resonances, and Σ and Λ particles are summarized in a table. From this table it appears that to each multiplet with T = 1, one can put in correspondence a singlet with T = 0 having the same quantum numbers and a near-lying mass. It is suggested that hypercharge is a characteristic of an interacting system that switches on strong dependence of all its properties on the isotopic spin. When hypercharge equals zero, the dependence on the isotopic spin value disappears and degeneracy takes place. (A.G.W.)

9445 GLOBAL SYMMETRIES AND WEAK INTERACTION SELECTION RULES. L. A. Radicati (Universita, Pisa, Italy), H. Ruegg, and D. Speiser. p.660-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

In a study of implications of global symmetry on weak interaction selection rules, selection rules for leptonic decays are obtained. Non-leptonic decays are considered, the validity of the S-principle is assumed, and conclusions reached are listed. (A.G.W.)

9446 REMARKS ON THE UNIFIED MODEL OF ELEMENTARY PARTICLES. Z. Maki, M. Nakagawa, and S. Sakata (Nagoya Univ., Japan). p.663-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Some problems which would destroy the compactness of the unified scheme of elementary particles are discussed. One problem is the possible existence of two kinds of neutrinos, one associated with electron and the other with muon. A new set of rules for minimal generalization of the model in order to allow decay processes with $\Delta S/\Delta Q = -1$ is introduced. (A.G.W.)

9447 GAUGE INVARIANCE AND VECTOR FIELDS. V. I. Ogievetskij and I. V. Polubarino. (Joint Inst. for Nuclear Research, Dubna, USSR). p.666-70 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The role of gauge invariance in possible construction of theories of elementary particles by analogy with electrodynamics is discussed. Specifically, the following points are considered: (1) gauge invariance as a principle for deducing the existence of vector fields; (2) gauge invariance theories and the spin on vector fields; (3) gauge invariance theory of a massive neutral vector field; (4) quantum electrodynamics in terms of field strengths. (A.G.W.)

9448 ρ-MESONS AND THE YANG-MILLS FIELD. J. C. Taylor (Cambridge Univ., Eng.). p.670-2 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A simple proof that the Yang-Mills-Shaw field must carry zero mass quanta, at least if current ideas about the analytic properties of Green's functions are correct, is presented. (A.G.W.)

9449 ELECTRODYNAMICS IN THE NON-LINEAR SPINOR THEORY. W. Heisenberg (Max-Planck-Institut für Physik und Astrophysik, Munich). p.675-80 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The interpretation of electrodynamics in the nonlinear spinor theory requires the solution of problems concerning the following: (1) boson eigenstates with rest mass zero, (2) properties of the photon in isospin space and the connection between hypercharge and strangeness, and (3) the numerical value of the coupling constant. The main steps in the mathematical treatment of each of these problems are described. (A.G.W.)

9450 A SPURION MODEL OF THE Ξ-PARTICLE. H. P. Duerr (Max-Planck-Institut für Physik und Astrophysik, Munich) and J. Géhéniau. p.681-2 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A nucleon Dirac equation was studied which was modified through the addition of nucleon-spurion interaction terms which are possible under the stated symmetry requirements. The model leads to definite predictions as to the existence and mass sequence of possible strange particle states and their relative intrinsic parities. (A.G.W.)

9451 THE NON-FIELD THEORY OF NON-ELEMENTARY PARTICLES. S. Weinberg (Univ. of California, Berkeley and Imperial Coll., London). p.683-5 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A new method for describing a neutral spinless particle formed from a set of elementary particles is presented and compared with the conventional Bethe-Salpeter approach. New possibilities opened up by the new method are discussed briefly. (A.G.W.)

9452 A SELF-CONSISTENT THEORY OF ELEMENTARY PARTICLES. A. Salam (Imperial Coll., London). p.686-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Certain guesses are made as to how to determine the constants g_π and (K/μ) involved in the following Lagrangian: $L = L_0 + L_1$ where $L_0 = -Z_2N^+(\gamma\partial + K)N - \frac{1}{2} Z_3[(\partial\pi)^2 + \mu^2\pi^2]$ and $L_1 = -g_\pi Z_1 N^+ N\pi + Z_2\delta K N^+ N + \frac{1}{2} Z_3\delta\mu^2\pi^2$. (A.G.W.)

9453 NON-LINEAR THEORY OF SCALAR FIELD. D. Blokhintsev (Joint Inst. for Nuclear Research, Dubna, USSR). p.687-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A model of nonlinear field theory is treated which is described by the Hamiltonian $\int[\frac{1}{2}\pi^2(x) + (C^2/2)\nabla\phi(x)^2 + V(\phi(x))]\, d^3x$ and by the quantum condition $[\pi(x), \phi(x')] = i\hbar\delta(x - x')$. (A.G.W.)

9454 QUANTIZATION OF A SELF-COUPLED BOSON FIELD. L. I. Schiff (Stanford Univ., Calif.). p.690-2 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The extent to which the recently observed multi-pion resonances can be accounted for in terms of a self-coupled pion field without explicit introduction of a pion-nucleon interaction is explored. A representation is chosen in which the state functions are emphasized, and they are approximated by means of the variational principle. This work is confined to the neutral, spin-zero boson field, but it is expected that the same methods can be applied to the pion field and to the scattering and bound states of more than two particles. (A.G.W.)

9455 ANALYTICAL PROPERTIES OF FEYNMAN GRAPHS. A. A. Logunov, I. T. Todorov, and N. A. Chernikov (Joint Inst. for Nuclear Research, Dubna, USSR). p.695-8 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The following problems are considered: (1) proof of one-dimensional dispersion relations in any finite order of perturbation theory by the method of majorization of diagrams, and the derivation of dispersion relations for partial wave amplitudes of the nucleon-nucleon and pion-pion scattering, and (2) derivation of parametrical equations of the surface of singularities of an arbitrary diagram and their application. (A.G.W.)

9456 COSMOLOGICAL INTERPRETATION OF THE MASS SPECTRUM OF ELEMENTARY PARTICLES. S. Hayakawa (Nagoya Univ., Japan). p.698-9 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An explanation is presented in cosmological terms for the previously proposed formula for the mass of any particle (except massless ones) $m = n \cdot 137\, m_e$, where m_e is the electron mass, n is an integral or half-integral number according to whether the particle concerned is a boson or a fermion, and the number 137 may be equated to $\hbar c/e^2$. (A.G.W.)

9457 ON QUANTIZED SPACE-TIME THEORY. V. G. Kadyshevskii (Joint Inst. for Nuclear Research, Dubna, USSR). p.700-3 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Quantized space-time theory is discussed in terms of a new geometry of p-space. (A.G.W.)

9458 GENERALISED COMMUTATION RELATIONS AND STATISTICS. S. Kamefuchi (Imperial Coll., London) and Y. Takahashi. p.703-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A general method of field quantization is presented, and its application to elementary particle physics is discussed. It is concluded that the statistics of all elementary particles are those of ordinary Fermi-Dirac or Bose-Einstein particles. (A.G.W.)

9459 THE ASYMPTOTIC BEHAVIOUR OF THE VERTEX FUNCTION IN "ONE-LOGARITHMIC" APPROXIMATION. S. Ya. Guzenko and P. I. Fomin (Physico-Technical Inst., Academy of Sciences, Kharkov). p.707 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A method of computing high-order radiative corrections taking into account "one-logarithmic" terms was developed. The result is given for the real part of the vertex function in the limiting case $|pq| \gg |p^2|$, $|q^2| \gg m^2$; $\ln|(pq/p^2)|$, $\ln|(pq/q^2)| \gg 1$. (A.G.W.)

9460 RESTRICTIONS ON THE MAGNITUDE OF COUPLING CONSTANTS IN QUANTUM FIELD THEORY. B. V. Geshkenbein and B. L. Ioffe (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.708-10 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Restrictions on the coupling constants for given masses are obtained by proceeding from the general principles of quantum field theory without resort to models. The discussion is based on the representation for the Green's functions in the form of the Lehmann-Källin expansion, and it is assumed that the vertex part obeys the dispersion relation. The 3-boson interaction is considered in detail, and results are given for the fermion case only. (A.G.W.)

9461 INTERACTIONS OF PIONS, NUCLEONS AND ANTINUCLEONS. G. Puppi (Universita, Bologna). p.713-26 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The production and properties of the ω, η, and ρ mesons are reviewed. Other subjects discussed briefly include the anomalous behavior of the dipion mass spectrum around 300 Mev, the ξ peak, peakology, and instruments used in high-energy physics. (A.G.W.)

9462 NUCLEON-NUCLEON SCATTERING. L. Lapidus (Joint Inst. for Nuclear Research, Dubna, USSR). p.726-36 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Recent work on nucleon-nucleon interactions at energies below 1 Bev is reviewed. Phase analyses by several groups are discussed; some results are presented and compared with new experimental data. (A.G.W.)

9463 PION AND NUCLEON PHYSICS—THEORETICAL. S. Mandelstam (Univ. of Birmingham, Eng.). p.739-50 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Theoretical procedures used to approach the pion-pion problem, difficulties encountered, and results obtained are reviewed. Calculations concerning the properties of the ω, η, and ζ mesons are discussed. Models suggested by several groups for the higher pion-nucleon resonances are described. Results of some calculations of nucleon-nucleon scattering are presented. (A.G.W.)

9464 ELECTROMAGNETIC PROPERTIES OF NUCLEONS AND PIONS. G. R. Bishop (Université, Paris). p.753-64 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Experimental and theoretical work on separation of the Dirac and Pauli form factors of the proton is reviewed. Data on proton and neutron form factors obtained by several groups are presented and compared with theoretical predictions. Recent experimental contributions regarding the photoproduction of π mesons near threshold, π^0 production in the Coulomb nuclear field, and photon production in pion interactions are summarized. (A.G.W.)

9465 ELECTROMAGNETIC PROPERTIES OF NUCLEONS AND PIONS. S. Fubini (CERN, Geneva and Università, Turin). p.767-75 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Recent theoretical work pertaining to electromagnetic properties of nucleons and pions is reviewed. Subjects considered include general properties of electron-nucleon scattering, a new choice of form factors, corrections to the Rosenbluth formula, theoretical models of the form factors, and the possible non-elementarity of the photon. The theory of photopion production and Compton scattering is discussed briefly. (A.G.W.)

9466 STRONG INTERACTIONS OF STRANGE PARTICLES—EXPERIMENTAL. B. P. Gregory (Ecole Polytechnique, Paris). p.779-91 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Experimental data presented at the conference on the following are summarized: the magnetic moment of the Λ^0, parity conservation in Λ production by high-energy π^-, charge independence in production of strange particles by $\pi^\pm$ on hydrogen and deuterium, hyperon-antihyperon production in high-energy p-$\bar{p}$ interactions, properties of well-established strange isobars (K^*, 888; Y_0^*, 1405; Y_0^*, 1520; Y_1^*, 1385; Ξ^*, 1532) and evidence of possible new resonant states (K^*, 730; K-$\bar{K}$ interaction; Y^*, 1685; Y^*, 1550; Λ-K and Σ-K resonant states). A table of bubble chamber pictures used in conference reports and a table of properties of known resonances are included. (A.G.W.)

9467 STRONG INTERACTIONS OF STRANGE PARTICLES. G. A. Snow (Univ. of Maryland, College Park). p.795-806 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Experimental evidence presented at the conference on the following is summarized: $\bar{K}\Lambda N$ parity, $\bar{K}\Sigma N$ parity, spin of the K^*, and $K^\pm$-p scattering. (A.G.W.)

9468 HIGH-ENERGY NEUTRINO INTERACTION IN MATTER. G. Danby, J. M. Gaillard, K. Goulianos, L. M. Lederman, N. B. Mistry, M. Schwartz, and J. Steinberger (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). p.809-17 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

An experiment carried out to observe the interactions of neutrinos from π decay in a spark chamber is described. Events of four types were seen: (1) single short tracks, (2) single long tracks, (3) vertex events, and (4) "shower" events. Arguments on the neutrino origin of the events are presented. The cross sections obtained for neutrino interactions agree reasonably well with theory. Results showed some evidence for existence of two types of neutrinos, some evidence against the neutrino flip hypothesis, and no evidence for the existence of an intermediate boson. (A.G.W.)

9469 WEAK INTERACTIONS: STRANGENESS-CONSERVING. L. Wolfenstein (Carnegie Inst. of Tech., Pittsburgh). p.821-6 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Recent experiments concerning the muon capture process and the conserved vector current hypothesis are summarized. It is concluded that the information obtained on strangeness-conserving weak interactions is probably consistent with universal V-A interaction with a conserved vector current. (A.G.W.)

9470 WEAK INTERACTIONS OF STRANGE PARTICLES. F. S. Crawford (Univ. of California, Berkeley). p.827-42 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Subjects discussed in this review of results obtained in the past two years include the following: meaning and method of measurement of the decay parameters α, β, and γ; the decays $\Xi^- \rightarrow \Lambda + \pi^-$, $\Lambda \rightarrow p + \pi^-$, $\Lambda \rightarrow n + \pi^0$, $\Sigma^+ \rightarrow n + \pi^+$, $\Sigma^+ \rightarrow p + \pi^0$, and $\Sigma^- \rightarrow n + \pi^-$; leptonic decays of strange particles and the rules $\Delta I = 1/2$ and $\Delta S = \Delta Q$; the $\Delta I = 1/2$ rule and non-leptonic K decays; three-body leptonic K-decay spectra and V-A theory; leptonic decays of hyperons; K^- and K^+ branching ratios; lifetimes of K_2^0, ΛH^4, ΛH^3, K_1^0, and Λ. (A.G.W.)

9471 THE THEORY OF WEAK INTERACTION. L. G. Okun (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.845-56 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

The present state of the theory of universal weak interaction is reviewed. Subjects considered include the following: the universality of the weak interaction, leptonic currents, conservation of the nucleonic vector current and the axial current, strange current and universality, the $\Delta Q = \Delta S$ rule, neutral K mesons, and τ decay. (A.G.W.)

9472 BIBLIOGRAPHY ON WEAK INTERACTIONS. PERIOD JANUARY 1961 TO MAY 1962. p.857-66 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

A list of about 300 papers on the theory of weak interactions covering the period January 1961 to May 1962 is presented. References are grouped first by subject and then listed in alphabetic order by authors. (A.G.W.)

9473 QUANTUM ELECTRODYNAMICS OF LEPTONS. S. M. Berman (Stanford Univ., Calif.). p.869-80 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Papers presented at the conference on the following subjects are summarized: the (g-2) value of the muon, photoproduction of muon pairs in carbon, scattering of 180 to 240 Mev/c negative muons from carbon, the hyperfine structure of muonium, atoms and ions formed by muons stopped in a hydrogen diffusion chamber, the problem of the higher order radiative corrections to the annihilation process $e^- + e^+ \rightarrow 2\gamma$, and the process $\gamma + Z \rightarrow \nu + \bar{\nu} + Z$. (A.G.W.)

9474 HIGH ENERGY PHYSICS (EXPERIMENTAL). G. Cocconi (Cornell Univ., Ithaca, N. Y.). p.883-93 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Experimental evidence presented at the conference on the following subjects is summarized: nucleon-nucleon collisions, pion-nucleon collisions, and inelastic processes in cosmic-ray interactions. (A.G.W.)

9475 HIGH-ENERGY PHYSICS: THEORETICAL. S. D. Drell (CERN, Geneva). p.897-913 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Progress made in the past year toward understanding high-energy phenomena is reviewed. The experimental and theoretical basis of Regge poles is pointed out. Theoretical developments since the introduction of Regge poles are summarized, and their experimental applications are discussed. (A.G.W.)

9476 GROUP THEORETICAL METHODS. B. d'Espagnat (CERN, Geneva). p.917-25 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962.

Definitions and general requirements involved in group theoretical methods are summarized. Two approaches by which group theory can hope to enter elementary particle physics are discussed: (1) the approach through strong interactions and (2) the approach through the weak interaction current. The status of several possible symmetry schemes is surveyed. (A.G.W.)

Neutron Physics

Refer also to abstract 9888.

9477 (BNL-5924) THE ANGULAR DEPENDENCE OF THERMAL NEUTRON SPECTRA IN LATTICES. Henry C. Honeck and Hiroshi Takahashi (Brookhaven National Lab., Upton, N. Y.). Jan. 1962. Contract [AT-30-2-GEN-16]. 40p.

Techniques are developed for computing the angular thermal flux spectrum emerging from a lattice. These methods are applied to water lattices, and it is found that the computed spectra are sensitive to the geometrical description of the lattice but insensitive to the anisotropic scattering by water. Comparisons with measured spectra indicate that corrections for gradients and the finite size of the experimental lattice are important. (auth)

9478 (BRL-1174) NEUTRON TRANSMISSION VERSUS THICKNESS FOR SOME COMMON MATERIALS. Frank J. Allen, Arnold T. Futterer, and William P. Wright (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Sept. 1962. 65p.

Curves of neutron dose transmission versus thickness are presented for laterally infinite slabs of several common materials for neutrons incident at several fixed energies and angles. The materials are: water, polyethylene (borated), iron, concrete, Nevada Test Site soil (area 7, dry and 100% saturated), laminated slabs containing one inch of iron on the outside, a variable thickness of iron on the inside, and 3, 6, 9, or 12 inches of polyethylene sandwiched between the layers of iron. The neutron source energies are 0.5, 1, 2, 3, 5, and 14 Mev; the incident angles are 0, 30, 45, and 70°. Additional material is presented for interpretation, evaluation, and use of the results given. (auth)

9479 (NP-12447) POLARIZACION DE NEUTRONES LENTOS A TRAVES DE HIERRO EN PRESENCIA DE UN CAMPO MAGNETICO. INFORME NO. 43. (Polarization of Slow Neutrons Passing Through Iron in the Presence of a Magnetic Field. Report No. 43). N. Mitrofanov and J. J. Van Loef (Chile. Universidad, Santiago. Instituto de Fisica y Matematicas). [nd.] 7p.

The possibility of obtaining a bundle of slow neutrons

with 26% polarization by magnetic interaction in a soft iron sample 2-cm thick was shown. The simple transmission depends strongly on the intensity of the magnetic field. The polarization was much lower than that obtained by previous workers. The reasons for this discrepancy are discussed. (J.S.R.)

9480 (NP-12458) THREE SOLUBLE PROBLEMS IN LINEAR TRANSPORT THEORY. Richard Edward Aamodt (Michigan. Univ., Ann Arbor). Aug. 1962. 58p.

Three exactly soluble problems in linear transport theory are considered. In the first problem, the one-velocity, time-independent, isotropic scattering neutron transport equation with r^{-1} cross sections is solved exactly by two-sided Laplace transforms. The homogeneous solutions and the Green's functions are exhibited for both the infinite medium and the finite sphere. The diffusion approximation is compared to the exact result. In the second problem, a typical translationally invariant linear transport problem for a half-space is solved by the eigenfunction method. Using some derived identities for the solution of the associated homogeneous Hilbert problem it is shown that the usual cumbersome integrals occurring in half-space problems can be reduced to a simple form. For the third problem the particle density of a simple model of the exosphere is obtained by solving exactly the collisionless Boltzmann equation. The main point of the solution is that it is a discontinuous, multivalued function of the constants of motion. Results, of course, agree with those of other methods based on Newtonian mechanics. (auth)

9481 (TID-15547) FAST NEUTRON FLUX PROFILES OF POLYETHYLENE SEPTA CRITICAL CONFIGURATIONS. G. D. Hickman and L. A. Dykeman (Knolls Atomic Power Lab., Schenectady, N. Y.). [1961]. Contract [W-31-109-eng-52]. 24p.

Fast neutron flux profiles were obtained for three different size core-polyethylene septa critical configurations. A comparison of these measurements with P-1 and P-3 approximations to the transport equation showed that the differences between the experimental and calculated fast neutron fluxes vary with the size of the core and polyethylene septum. The experimental and calculated fast fluxes were in best agreement using a P-1 solution in the largest core-septum configuration, while with a P-3 solution in the smallest configuration. This behavior was shown to be consistent with the proposal that the average high energy scattering cross sections of Al, C, or both as calculated by the MUFT code are in error. (auth)

9482 (WAPD-T-1481) A COMPARISON OF THE PROPERTIES OF THE NELKIN AND RADKOWSKY THERMAL NEUTRON SCATTERING KERNELS FOR WATER. E. M. Gelbard, J. A. Davis, and E. Schmidt (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Mar. 1962. Contract [AT-11-1-GEN-14]. 11p.

The coefficients ω_0, D_0, C and E in the expansion $\omega = \omega_0 + D_0B^2 - CB^4 + EB^6 + \ldots$ were computed using the Radkowsky and Nelkin kernels. It was found that both kernels give very similar pulse parameters. Extrapolation distances were computed, using both kernels, for pulsed slabs of water. Again no significant differences were observed. Differences between the Nelkin and Radkowsky flux shapes in TRX lattices are quite small: they would be difficult to detect experimentally. It appeared that thermal neutron flux shapes and decay rates are not very sensitive to details in the structure of the scattering kernel. Yet neither the Nelkin nor the Radowsky kernels yielded flux shapes and decay rates in good agreement with experiment. (auth)

9483 A COMPARISON OF SOME RECENT CALCULATIONS OF NEUTRON TRANSPORT IN AIR. M. B. Wells (General Dynamics, Fort Worth, Tex.). Health Phys., 8: 543-9(Oct. 1962).

Monte Carlo computations performed by the Rand Corporation, the Los Alamos National Laboratory, the Sandia Corporation, and General Dynamics/Fort Worth to determine the transport of 3 and 14 Mev neutrons in air and air-ground geometries are compared, and the differences between these computations are discussed. Air-transport calculations for a 3 Mev neutron source were performed at GD/FW, with the neutron cross-sections used in the Sandia and Los Alamos calculations serving as cross-section input data. The GD/FW results were found to be in good agreement with the Los Alamos air-ground calculations, but to disagree with the Sandia calculations for air only. Monte Carlo calculations of the transport of neutrons from a point isotropic fission source in air, as made at GD/FW, are compared with results obtained from a moments-method calculation performed at the Nuclear Development Corporation of America. The differences between these calculations are discussed. (auth)

9484 THE SUPPRESSION OF RESONANCE ABSORPTION IN INDIUM ANTIMONIDE. L. G. Penhale and D. E. Vaughan (Royal Military Coll. of Science, Shrivenham, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 247-51(May 1962). (In English)

Resonance neutron absorption both in antimony and indium makes it possible to achieve uniform neutron irradiation of thick samples of indium antimonide by simple insertion in a neutron flux. A technique is devised in which the fluxes of resonance neutrons are attenuated by surrounding the specimen with suitable thicknesses of indium and antimony. (auth)

9485 THE SPECTRUM OF THE NEUTRON TRANSPORT OPERATOR FOR THE INFINITE SLAB. Joseph Lehner (Michigan State Univ., East Lansing and Sandia Corp., Albuquerque, N. Mex.). J. Math. Mech., 11: 173-82(Mar. 1962). (SCR-558)

The operator equation for neutron transport in an infinite slab ($-\underline{a} < \underline{x} < \underline{a}$) is given in the form $\partial\psi/\partial\underline{t} = B\psi$, where $\psi = \psi(\underline{x},\mu,\underline{t})$ is proportional to the density of the neutron beam at point $\underline{x}$ traveling in direction μ at time $\underline{t}$, and B is an operator that is defined such that the boundary conditions enter in a natural way. The spectrum of B is found to be composed of a point spectrum, a residual spectrum, and a continuous spectrum. (T.F.H.)

9486 THE LINEAR EXTRAPOLATION LENGTH AND BLACKNESS FOR INFINITE CYLINDERS. S. A. Kushneriuk (Atomic Energy of Canada Ltd., Chalk River, Ont.) and K. Jirlow. J. Nucl. Energy, Pts. A & B, 16: 464-6(Sept. 1962).

It is shown that low-order spherical harmonic approximations give poor approximation of the linear extrapolation length for neutron absorption in cylinders in scattering media, although the disadvantage factor is described fairly well. More exact equations are derived in terms of the cylindrical blackness. (D.L.C.)

9487 A MODIFICATION OF THE GREULING-GOERTZEL METHOD. K. Meyer (VEB Entwicklung und Projektierung Kerntechnischer Anlagen, Berlin). Kernenergie, 5: 601-5(Aug. 1962). (In German)

For a more accurate treatment of the position energy dependent slowing down, a substitute expression was defined, using a procedure developed from the Greuling-Goertzel method, for the first spherical moment of the angular dependent transmission cross section. This substitute ex-

pression was used in the discussion of the solution of the momentum equations for the calculation of the slowing down surface. It is shown that for constant cross sections this agrees asymptotically with the solution of the exact problem. However, deviations are obtained when the usual methods are used. (tr-auth)

9488 NEUTRON FLUX AND SPECTRUM MEASUREMENT WITH RADIOACTIVANTS. John Moteff (General Electric Co., Cincinnati). Nucleonics, 20: 56-60(Dec. 1962).

Methods for determining neutron flux and spectrum by means of induced radioactivity are reviewed together with a discussion of pertinent reaction cross sections and neutron spectra. (auth)

9489 COLD NEUTRON SCATTERING AND DIFFUSIVE MOTIONS IN HYDROGEN BONDED LIQUIDS. K. E. Larsson (Royal Inst. of Tech., Stockholm) and K. S. Singwi. Phys. Letters, 3: 145-7(Dec. 15, 1962). (In English)

An analysis of the "quasi-elastic" scattering of cold neutrons in hydrogeneous liquids in which the scattering is mostly incoherent gives an insight into the nature of diffusive motions of the entity containing protons. A series of cold neutron scattering experiments was performed in glycerol to investigate the scattering and diffusive motion phenomena. The width of the quasi-elastic peak at five different temperatures and determinations of the effective diffusion constant values are presented and discussed. The frequency spectra of glycerol at 266°K is derived from the observed inelastically scattered spectra in both solid and liquid phases. The evidence presented indicates that H-bonded liquids behave dynamically very much like quasi-crystalline solids. (H.D.R.)

9490 THE SENSITIVITY OF THE ACTIVATION METHOD IN PHOTONEUTRON MEASUREMENTS. I. A. Yaritsyna. Tr. Inst. Kom. Standartov, Izmeritel. Proborov Sov. Min., No. 55(115) 69-73(1961).

The γ activations of various elements were compared and methods of activating Mn in a potassium permanganate solution and activating ethyl iodide are described. Experiments revealed that γ rays with an intensity of not less than 10^{-4} quanta per decay can be studied using Ag foils. It was also found that Mn, Rh, In, Au, I, Dy, Ir, and V cannot be recommended for detecting hard γ rays of low intensity. For activating Mn, a 4% $KMnO_4$ solution, into which a Be or D_2O block with a γ-ray emitter was submerged was used. The irradiated solution was filtered through paper filters that were burned and the activity of the ashes measured by a β counter under standard conditions. Owing to the relatively long half life of Mn^{56}, the method permits studying sources with hard γ lines with an intensity of up to 10^{-6} quanta per decay. By increasing the quantity of Be and D_2O and the solution surrounding the photoneutron source and by using a source with higher activity, hard γ rays with an intensity of up to 10^{-7} quanta per decay can be studied. The method of activating ethyl iodide was much the same, except that many more neutrons were captured by the iodine and the total activation cross section in the thin layer was 4 times larger. The necessity of working with a large quantity of strongly volatile liquid and the need for the chemical separation of the iodine and preparation of AgI are among the method's disadvantages. However, in principle the method may be used for detecting hard γ rays with an intensity of up to 10^{-7} to 10^{-8} quanta per decay. Experiments showed that the two methods are among the most sensitive for detecting neutrons. (P.C.H.)

9491 THE USE OF SCINTILLATION DETECTORS IN FAST NEUTRON DOSIMETRY. S. I. Slepyshkov and M. F. Yudin. Tr. Inst. Kom. Standartov, Izmeritel. Priborov Sov. Min., No. 55(115), 74-80(1961).

Two fast neutron scintillation counters are described. One is a multilayer type, permitting neutron doses between 0.2 and 5 Mev to be measured within an error of ±10%, beginning with a dose power of 0.1 μ rad/sec and over; the device ensures a good discrimination of γ-radiation; the second is a spherical type, permitting the fast neutron flux to be measured at a density of 10 neutron/cm^2 sec and over within an error of ±(10 to 15)%. The drawbacks of the devices are: the indications are dependent upon the direction of neutron motion, and are independent of the neutron energy only within a rather narrow range. An advantage of the devices is their high sensitivity. (Referativnyy zhurnal, Fizika, 12: No. 3, 1962)

9492 THE POINT SOURCE TRANSPORT SOLUTION FOR THE POSITION AND VELOCITY DEPENDENT NEUTRON DISTRIBUTION IN A SPHERICAL BODY OF NON-MULTIPLYING MATERIAL. John Martin Norwood. Thesis, Austin, Tex., Univ. of Texas, 1962. 82p.

The transport equation is solved for the position and velocity dependent neutron distribution arising from a point source at the center of a homogeneous spherical body surrounded by empty space. The source is assumed to be isotropic and monochromatic, and neutron scattering is assumed to be elastic and isotropic in the center of mass system. The scattering and total cross sections are taken to be independent of energy. The transport equation is solved by use of the spherical harmonics method without resorting to the P_n approximation, and accordingly the solution might be called a P_∞ solution. The solution is given for points inside, on the surface, and outside of the sphere, and it should apply particularly well to light elements such as carbon and also to hydrogenous media such as water. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9493 THERMAL NEUTRON SOURCES AND CALIBRATION PROBLEMS OF THERMAL, INTERMEDIATE, AND FAST NEUTRONS. R. D. Vassil'ev, G. A. Dorofeev, T. S. Mordovskaya, V. I. Petrov, and M. I. Pimenov. IAEA Preprint SM-36/113. 17p. (In Russian)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Thermal neutron yields from 15- and 20-cm paraffin spheres with central (α – Be) neutron sources and neutron spectra emitted by a 20-cm diameter sphere heated to 80°C were measured. The slow neutron spectra are well described by a Maxwell distribution at 600°K. Recommendations are made for neutron radiometric calibration by means of such a source. Problems of thermal, intermediate, and fast neutrons are discussed. (tr-auth)

9494 SPECIFICATION AND MEASUREMENT OF REACTOR NEUTRON SPECTRA. J. Romanko and W. E. Dungan (General Dynamics, Fort Worth, Tex.). IAEA Preprint SM-36/84. 16p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Current analytical and experimental techniques used at a typical nuclear facility in defining and measuring neutron spectra from reactor and pulse sources are compiled and analyzed. Analytical representations of reactor neutron spectra, both purely water-moderated and boral attenuated, are briefly derived. A fairly comprehensive treatment of neutron-flux measurements is given including a description of the materials used, the methods of fabrication, the procedures for exposing and counting irradiated foils, the re-

duction of counting data, the calibration procedures, as well as the factors which contribute to the precision and experimental error. The devices considered include foil-type neutron detectors such as gold, indium, and sulfur for the measurement of thermal, resonance and fast neutron fluxes, and for estimating spectral shapes. Radiation monitoring procedures in typical radiation effects experiments, for example, in high temperature and cryogenic environments, are described. (auth)

9495 FLUX AND SPECTRUM MEASUREMENTS OF PRIMARY AND MODERATED NEUTRON SOURCES. E. Tochilin (Naval Radiological Defense Lab., San Francisco). IAEA Preprint SM-36/90. 10p. (In English)

To be published in Proceedings of the IAEA Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

The Naval Radiological Defense Laboratory has an active program of neutron standardization involving fundamental measurements of flux, spectrum and dose. Radioactive (α,n) neutron sources maintained by the Laboratory include RaBe, PuF_4, and four PuBe sources. Comparative neutron emission rates for those sources were determined by two separate methods. These included: (1) The manganese sulfate bath with appropriate corrections made for fast neutron escape or capture and for thermal neutron capture by the source; (2) long counter measurements corrected for energy response and source anisotropy. Agreement to within 1 per cent was obtained by the two independent methods. A RaBe source calibrated against the National Bureau of Standards neutron standard was used as a primary reference. Spectral measurements of PuBe and PuF_4 were made with nuclear emulsions. By the use of cylindrical plastic and lead absorbers, an effort was made to modify the PuBe spectrum and thereby obtain additional calibration points for instrument response studies. Changes in neutron spectrum were initially studied with the double-moderator method of Depangher, followed by later measurements with nuclear emulsions. From flux and spectral measurements of the primary and moderated radioactive sources, the first collision tissue dose was calculated and, in turn, compared to experimental measurements of absorbed dose with proportional counters designed according to the Bragg-Gray principle. The energy responses of several neutron dosimeters were also studied, with additional neutron energies provided by a positive ion accelerator. An alternate to several existing moderator methods for evaluating neutron energy spectra was developed. In this scheme the conventional BF_3 detector in a long counter was replaced with a tube containing indium foils sandwiched between polyethylene spacers. A family of activation curves along the axis of the counter was obtained for monoenergetic accelerator neutrons extending from 0.2 to 5.1 Mev. The detector was used together with nuclear emulsions in an experiment to determine the moderation of a simulated fission neutron spectrum in passing through a hydrogenous moderator. (auth)

9496 APPARATUS FOR THE PRODUCTION OF INTENSE BURSTS OF NEUTRONS. Nils L. Muench (to Jersey Production Research Co.). U. S. Patent 3,070,697. Dec. 25, 1962. Filed Oct. 4, 1957.

An apparatus is described for investigating subsurface formations penetrated by a borehole. The formations are bombarded with neutrons and induced radioactivity is monitored. The design of a device for producing intense bursts of neutrons is set forth. (R.J.S.)

9497 NEUTRON SOURCE. J. L. Richmond and C. E. Wells (to U. S. Atomic Energy Commission). U. S. Patent 3,073,768. Jan. 15, 1963.

A neutron source is obtained without employing any separate beryllia receptacle, as was formerly required. The new method is safer and faster, and affords a source with both improved yield and symmetry of neutron emission. A Be container is used to hold and react with Pu. This container has a thin isolating layer that does not obstruct the desired Pu–Be reaction and obviates procedures previously employed to disassemble and remove a beryllia receptacle. (AEC)

Nuclear Properties and Reactions

9498 (ANL-6598) ISOMERIC-YIELD RATIOS IN NUCLEAR REACTIONS. (WITH A COMPILATION OF EXPERIMENTAL DATA). James Wing (Argonne National Lab., Ill.). Sept. 1962. Contract W-31-109-eng-38. 144p.

Experimental procedures are briefly described for the determination of the ratios of cross sections for the formation of isomeric states in nuclear reactions. Much available experimental data on isomeric yield ratios in nuclear reactions is compiled. Some of the collected data are discussed in terms of angular-momentum effects in nuclear reactions. (230 references).

9499 (ANL-6623) SURFACE AND VOLUME PROPERTIES OF GROUND STATE NUCLEAR MATTER IN THE HARTREE-FOCK AND PUFF-MARTIN APPROXIMATIONS. John C. Reynolds (Argonne National Lab., Ill.). Oct. 1962. Contract W-31-109-eng-38. 121p.

A method was derived for computing the ground state properties of a spatially inhomogeneous self-bound system of many particles. This method was used to compute the density and effective potential across a plane surface of nuclear matter in the Hartree-Fock approximation and in an approximation developed by R. D. Puff and P. C. Martin which takes into account certain two-body correlation effects. A general theory of many-particle systems was developed in terms of the n-particle field correlation or Green's functions. It is shown that, for zero temperature and pressure, this treatment may be extended to inhomogeneous systems by replacing the condition of spatial homogeneity on the Green's functions by appropriate asymptotic boundary conditions. Such conditions were derived for a semi-infinite volume of material with a single plane surface. This development was then applied to nuclear matter in the Hartree-Fock approximation. A solution for homogeneous matter was first obtained. A Gaussian interparticle potential was used, with depth and range fitted to low-energy scattering data. Nuclear saturation was produced by using an admixture of exchange forces. The resulting binding energy per particle was –3.63 Mev, and the interparticle spacing was 1.25 fermi. These may be compared with experimental values of –15.75 Mev and 1.1 to 1.2 fermi. The inhomogeneous geometry was then considered. A short development was made of an approximation analogous to the Thomas-Fermi approximation in atomic physics, but it is shown that this approach breaks down for nuclear matter and leads to inconsistencies because of the exchange nature of the forces. A numerical solution for the inhomogeneous geometry was then obtained by an iterative self-consistent procedure, using an effective mass approximation. The thickness of the resulting surface (the distance over which the density drops from 90 to 10% of its asymptotic value in the interior) was 2.01 compared with experimental value of 2.5 ± 0.2 fermi, and the density function exhibited oscillations near the surface due to the sharpness of the edge. The effective potential was strongly momentum-dependent but is nearly isotropic. A similar

treatment was carried out for the Puff-Martin approximation. In this approximation the effective potential becomes an energy dependent function which is expressed as a folding integral of the spectral function of the system and a two-body scattering matrix. An ambiguity in the definition of the pressure appeared in the approximation; it was resolved by showing that a pressure expression derived from local-transport considerations must be used to insure the existence of time-independent solutions for the inhomogeneous case. Puff was followed in using an interparticle potential consisting of a separable Yamaguchi potential plus an S-state repulsive hard shell. In the homogeneous case the approximation led to a binding energy per particle of −14.4 to −17.5 Mev and an interparticle spacing of 0.871 to 1.01 fermi (depending on which expression for the pressure is set equal to zero to obtain an uncompressed system). A computation of the density correlation function is given. The inhomogeneous case was again treated by an iterative self-consistent procedure with an effective-mass approximation. The results gave a surface thickness of 2.33 fermi and a surface energy of 18.79 Mev, which may be compared with experimental values of 2.5 ± 0.2 fermi and 17.804 Mev. As in the Hartree case, the effective potential was nearly isotropic, but there was no significant oscillations inside the surface. (auth)

9500 (HW-SA-2516) CALORIMETRIC DETERMINATION OF THE HALF-LIFE OF ANTIMONY-124. D. M. Fleming and I. T. Myers (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 22, 1962. Contract AT(45-1)-1350. 10p.

To make use of Sb-Be neutron sources in dosimetry, a decay correction based on half lives is necessary which is more accurate than published values. The design and operation of a gamma radiation calorimeter used in determining this value are described. The half life value obtained for Sb^{124} is 60.20 ± 0.03 days. This error represents a confidence level of about 95%. (J.R.D.)

9501 (IS-590) PRECISE MEASUREMENT OF THE K-SHELL INTERNAL CONVERSION COEFFICIENT OF THE 344-kev, E2 TRANSITION IN Gd^{152}. Guy Schupp and E. N. Hatch (Ames Lab., Ames, Iowa). Aug. 1962. Contract W-7405-eng-82. 98p.

History of work on internal conversion coefficients and surveys of theory and experimental methods involved precede description of the coincidence counter built for these latest experiments. Measurement of the K-shell internal conversion coefficient of the 344-kev E2 transition in Gd^{152} yields a value of 0.0283 ± 0.0008 that disagrees unaccountably with theoretical calculations, but agree with other measurements. The value obtained for the 122-kev transition agrees well with theory, and values for the 123- and 87-kev E2 transitions in Gd^{154} and Dy^{160} are also included. (73 references). (D.C.W.)

9502 (JINR-P-1068) RASSHCHEPLENIE DVUKHKVAZICHASTICHNYKH UROVNEI V CHETNO-CHETNYKH YADRAKH. (Splitting of Two-Quasi-Particle Levels in Even-Even Nuclei). N. J. Pyatov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 8p.

An attempt is made to account for the splitting of the two-quasiparticle levels in even-even nuclei by means of the central interaction of the unpaired nucleons. It has been shown that the main contribution to the splitting energy is given by the exchange forces, the state with antiparallel nucleon spins being the lowest one by its energy. The presence of the spin forces leads to the decrease of the splitting energy. If the spin forces are 25% of the total pairing forces, then the splitting disappears. The splitting of the two-quasiparticle level is symmetrical only when K = 0. (auth)

9503 (JINR-P-1098) UGLOVYE RASPREDELENIYA α CHASTITS I POLNYE SECHENIYA REAKTSII $C^{12}(t,\alpha_0)B^{11}$. (Angular Distributions of α-Particles and Total Cross Sections for the $C^{12}(t,\alpha_0)B^{11}$ Reaction). K. Nedvedyk, V. I. Salatskij, I. V. Sizov, and V. I. Furman (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Neutron Physics). Oct. 6, 1962. 7p.

The angular distributions of α particles from the $C^{12}(t,\alpha)B^{11}$ reaction are measured in the triton energy region 425 to 1140 kev. The shape of the angular distributions changes noticeably when the tritium ion energy is 0.66 Mev, which corresponds to the resonance of this reaction. The total cross sections for the $C^{12}(t,\alpha)B^{11}$ reaction are obtained. (auth)

9504 (NP-12336) THE NUCLEAR PROPERTIES OF RHENIUM. Quarterly Technical Progress Report No. 11, June 8, 1962 through September 8, 1962. R. A. Karam, T. F. Parkinson, and M. F. Panczyk (Florida. Univ., Gainesville). Sept. 8, 1962. Contract NOas 60-6021-c. 16p.

A complete decay scheme of Re^{184} and Re^{184*} (2.2 day) based on the collective model is proposed. Based on that scheme the $Re^{185}(n,2n)Re^{184}$ cross section reported in the previous report was recalculated to be 1.91 ± 0.6 barns. Furthermore, the cross section for the $Re^{185}(n,2n)Re^{184*}$ reaction was found to be 1.12 ± 0.4 barns. The Re(n,p)W cross section for 14.1-Mev neutrons was calculated to be 32.2 millibarns. This value is not exact but it seems to be about the right order of magnitude. Possible excited states of Au^{196} were calculated by using the shell model. (auth)

9505 (NP-12441) MEDICION DEL FLUJO NEUTRONICO DE LA REACCION $C^{12}(d,n)N^{13}$ A BASE DE LA ACTIVIDAD DEL N^{13}. INFORME NO. 28. (Measurement of the Neutron Flux of the Reaction $C^{12}(d,n)N^{13}$ Based on the Activity of N^{13}. Report No. 28). A. Keller (Chile. Universidad, Santiago. Instituto de Fisica y Matematicas). Aug. 1960. 13p.

The principal problem in the measurement of neutron flux from the reaction $C^{12}(d,n)N^{13}$, based on the activity of N^{13}, is the possibility of nitrogen escape. A method for the measurement of possible N^{13} losses is described, and measurements with TiC targets irradiated with 600-kev deuterons are reported. The formulas for the calculation of the neutron flux are indicated. (tr-auth)

9506 (PAN-202) ENERGY DEPENDENCE OF THE DEUTERON ELASTIC SCATTERING FOR NUCLEI IN THE REGION OF A = 40. A. Strzałkowski (Polish Academy of Sciences. Inst. of Nuclear Physics, Krakow). Aug. 1962. 24p.

Disappearance of the third maximum in the angular distribution patterns for nuclei with mass numbers of about 40 is investigated by studying angular distributions of deuterons elastically scattered from Al, S, Ca, and Ti at energies from 10 to 13 Mev. Curves of scattering cross sections and tables of target thicknesses are included. (D.C.W.)

9507 (PAN-203) ELASTIC SCATTERING OF 12.8 Mev DEUTERONS ON SOME LIGHT NUCLEI. L. Freindl, H. Niewodniczański, J. Nurzyński, M. Słapa, and A. Strzałkowski (Polish Academy of Sciences. Inst. of Nuclear Physics, Krakow). Aug. 1962. 21p.

Technique for studying the angular distributions of 12.8 Mev deuterons elastically scattered from Be, C, Mg, and

Ca is briefly discussed, and values obtained for the differential cross sections are shown. Pronounced diffraction structures appeared in all cases in the angular distributions, and the third maximum is found to disappear for elements heavier than calcium. (D.C.W.)

9508 (PAN-207) A STUDY OF (d,^{3}He) REACTION LEADING TO ^{26}Mg. F. Pellegrini and S. Wiktor (Polish Academy of Sciences. Inst. of Nuclear Physics, Krakow). Sept. 1962. 13p.

The $Al^{27}(d,He^3)Mg^{26}$ reaction is studied at a bombarding energy of 12.8 Mev using magnetic analysis and nuclear emulsions as detector. Angular distributions leading to the ground state and to the 1.83 and 2.94 Mev excited states of the residual Mg^{26} nucleus are measured and compared with the plane wave Born approximation theory. The cross sections, I values, and relative reduced widths are obtained. The relative reduced widths are compared with the predictions of the rotational model and in general a good agreement, within 20 per cent, is found. In particular, the experimental results obtained in this work seem to indicate that the ground and 1.83 Mev states are members of the K = 0 band and the 2.94 Mev state is the first member of the K = 2 rotational band. (auth)

9509 (PAN-213) SCATTERING OF SLOW-NEUTRONS BY LIQUID H_2S. H. Rżany and J. Ściesinski (Polish Acaedmy of Sciences. Inst. of Nuclear Physics, Kraków). Oct. 1962. 7p.

The total scattering cross section in liquid H_2S is measured for neutrons in the energy range of 0.0058 to 0.187 ev. The results obtained are compared with the gaseous H_2S cross section and with the Krieger-Nelkin curve. Evidence of a slight hindrance of molecular rotations was obtained. (auth)

9510 (PAN-214) SCATTERING OF SLOW-NEUTRONS BY NH_3 MOLECULES. PART II. SCATTERING BY LIQUID NH_3. J. A. Janik, H. Rzany, and J. Ściesiński (Polish Academy of Sciences. Inst. of Nuclear Physics, Krakow). Oct. 1962. 7p.

The total scattering cross sections in liquid and gaseous NH_3 are measured for neutrons in the energy range 0.0058 to 0.187 ev. The results obtained are compared with the Krieger-Nelkin curve. The results show evidence of the hindrance of molecular rotations in the liquid NH_3. (auth)

9511 (PAN-348/VI) EMISSION OF SLOW PARTICLES IN HIGH ENERGY INTERACTIONS OF NUCLEONS WITH HEAVY NUCLEI IN EMULSION. Pelagia Ciok, David M. Haskin, Erich Lohrmann, Teresa Saniewski, and Przemyslaw Zieliński (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). July 1962 20p.

The emission of slow particles (834 particles producing "black tracks") is investigated in a selected sample of 94 cosmic ray jets, caused by nucleons with energies 10^{10} to 10^{14} ev in collisions with heavy emulsion nuclei ($N_h > 8$). The angle and range distributions are compared with the predictions of the evaporation model and an approximate agreement is found for the usually accepted values of the nuclear temperature and average velocity of the evaporating nuclei and for low values of the effective Coulomb barrier. 23 references. (auth)

9512 (PAN-358/I-A) EXPERIMENTAL MATRIX ELEMENT FOR THE ELECTRON CAPTURE TRANSITION $Er^{165} \rightarrow Ho^{165}$. Jan Żylicz, Ziemowid Sujkowski, Jerzy Jastrzebski, Olgierd Wołczek, Sławomir Chojnacki, and Igor Yutlandov (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). [1962]. 40p.

K x-ray coincident and single internal bremsstrahlung spectra taken in a study of radiative capture in the decay of erbium-165 agree well with theoretical predictions. A Q value of 371 ± 6 kev is found, and upper limits for decay branching to the excited states of holmium-165 are established. The half life of erbium-165 is calculated as 10.39 ± 0.07 hours, while an ft value of (4.33 ± 0.17) × 10^4 sec for the ground state transition is found. Graphs of decay schemes and various spectra are included. (40 references). (D.C.W.)

9513 (TID-17489) THE MÖSSBAUER EFFECT AND LATTICE DYNAMICS. K. S. Singwi (Argonne National Lab., Ill.). Sept. 1962. Contract [W-31-109-eng-38]. 20p. (UAC-6857)

Those aspects of the Mössbauer effect that are directly concerned with the dynamics of atomic motion in solids and liquids are discussed. A comparison of slow neutron scattering and the resonance scattering of gamma rays is presented. The diffusion broadening of a Mössbauer line is discussed. The effects of the second order Doppler shift are described. The use of neutron scattering and the Mössbauer effect to determine the influence of impurity atoms on lattice dynamics is discussed. The possibility of the scattering of gamma rays and neutron in liquid He^3 in order to measure the velocity of zero sound is also discussed. (M.C.G.)

9514 (TID-17675) EVALUATION OF A MULTIPLE COINCIDENCE TECHNIQUE FOR A LOW FLUX DETERMINATION OF NEUTRON CAPTURE TO FISSION RATIOS IN U^{233}, U^{235}, and Pu^{239}. M. M. Bretscher and A. DeVolpi (Argonne National Lab., Ill.). Sept. 10, 1962. Contract [W-31-109-eng-38]. 43p. (RED-EPM-103)

A method is discussed for a low-flux determination of the neutron-capture-to-fission ratio α. The technique rests on the fact that several prompt gammas are emitted in both fission and capture events. It is proposed to surround a fission chamber, placed in the path of a collimated neutron beam, with a series of gamma counters which will detect prompt gamma radiation emitted by the chamber. Requiring coincidences between any pair of gamma radiation detectors reduces the background count. Fission is distinguished from capture by the additional requirement that the gamma-gamma counts be in coincidence with the fission counts. The apparatus is calibrated in a thermal neutron beam for which α is known from independent measurements. The accuracy of the method is limited, and for fast neutrons low count rates of the order of a few counts per second are expected. The question as to whether the energy distribution of neutrons in the beam is representative of that in the reactor core remains unanswered. A series of preliminary experiments using a Van de Graaff generator to provide a monoenergetic neutron beam are proposed. These experiments would provide valuable calibration data and at the same time measure the fission and capture gamma ray multiplicities as a function of neutron energy. No such information is currently available in the literature. (auth)

9515 (TID-17683) RESOLVED RESONANCE INTEGRALS AT 0°K FOR U^{235}. Reactor Physics Constants Center Newsletter No. 8. C. N. Kelber (Argonne National Lab., Ill.). Oct. 1, 1962. Contract W-31-109-eng-38. 91p.

A tabulation of resolved resonance absorption integrals and resolved resonance fission integrals is presented for U^{235} at 0°K. (M.C.G.)

9516 (UCRL-9995) THE NEUTRON-DEFICIENT YTTRIUM ISOTOPES Y^{82}, Y^{83}, AND Y^{84}. V. Maxia, W. H. Kelly, and D. J. Horen (California. Univ., Berkeley. Lawrence Radiation Lab.). Dec. 1961. Contract W-7405-eng-48. 12p.

Divergences in values of the half life of Y^{85} have been resolved by discovery of a new Y^{85} isomeric state, and the half lives of Y^{84}, Y^{83}, and Y^{82} have been evaluated. Powdered arsenic metal targets were bombarded in the Berkeley heavy-ion linear accelerator with carbon ions. Determination by direct decay gives a half life of 39 ± 1 min for Y^{84}. Timed chemical separation values of 9 ± 3 min and 8 ± 2 min were obtained for Y^{82} and Y^{83}, respectively. Gamma spectra of Y^{84} and Sr^{83} are shown. (D.C.W.)

9517 (UCRL-10417) TWO TOPICS IN PION PHYSICS. I. PHOTOPRODUCTION OF NEUTRAL PIONS FROM COMPLEX NUCLEI AND THE PAIR-CORRELATION FUNCTION. II. THE RELATIVE RATE OF ABSORPTION OF NEGATIVE PIONS IN HYDROGEN AND DEUTERIUM (thesis). Robert Henry Traxler (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 13, 1962. Contract W-7405-eng-48. 82p.

A simple theory of the photoproduction of π^0 mesons from complex nuclei based on the impulse and closure approximation is studied. The theory is compared with an experiment of Goodwin, Anderson, and Kenney that shows the dependence of the number of decay gammas from π^0 mesons photo-produced from various nuclei as a function of the atomic number at 45, 90, and 135 degrees for incident photon energies from threshold to 350 Mev. The dependence measured near threshold and at 45 degrees does not agree with the simple theory nor is it consistent with partial elastic production. By a method of Placzek and Wick the corrections to the simple theory are estimated, and found to be large near threshold. These corrections may explain the discrepancy between the theory and the experimental results. No information about the nuclear-pair correlation function is obtained. The impulse approximation is used to calculate the relative ratio of the radiative absorption rate of π^- mesons absorbed in hydrogen and deuterium from an atomic s state. The calculated value of the ratio $T = R(\pi^- + d \rightarrow 2n + \gamma)/R(\pi^- + p \rightarrow n + \gamma)$ is 0.83 ± 0.08. The experimental value is 0.41 ± 0.06. The closure approximation is used to evaluate T. By a method due to Placzek the error due to the closure approximation is shown to be small. (auth)

9518 (USNRDL-TR-593) GAMMA RAYS OF In^{115}. J. P. Hurley, R. M. Brown, and C. E. Mandeville (Naval Radiological Defense Lab., San Francisco). Oct. 26, 1962. 15p.

The gamma spectrum of In^{115} is investigated with a scintillation spectrometer. The 1.14 Mev gamma ray is found to be emitted in (0.081 ± 0.016) percent of the disintegrations and the gamma ray at 1.41 Mev in (0.035 ± 0.007) percent of the disintegrations. The results are interpreted as showing evidence of the presence of at least two levels in the vicinity of 1.4 Mev in the level scheme of In^{115}. (auth)

9519 (WASH-1040) COMPILATION OF REQUESTS FOR NUCLEAR CROSS SECTION MEASUREMENTS. John R. Stehn, comp. (Nuclear Cross Section Advisory Group, AEC). Sept. 1962. Contract [AT(30-2)-Gen-16]. 54p. (EANDC(US)-30"U")

A compilation of requests for nuclear cross sections is presented. The cross section requests are tabulated in groups under elastic scattering, nonelastic scattering, fast total and capture, thermal, resonance parameter, thorium and heavier nuclei, and high energy proton reactions. (J.R.D.)

9520 A CONTRIBUTION TO THE PROBLEM OF INELASTIC MAGNETIC SCATTERING OF POLARIZED NEUTRONS IN Fe AND Ni. L. Valenta and Št. Zajac (Faculty of Technical and Nuclear Physics, Prague). Acta Phys. Acad. Sci. Hung., 15: 29-36(1962). (In English)

Magnetic small-angle scattering of slow polarized neutrons is studied in Fe and Ni at 0°K by means of the spin-wave theory. The cross section is calculated as a function of the polarization of the incoming and scattered neutrons, supposing the spin of the incoming particles to be polarized parallel or antiparallel to the spontaneous magnetization of the crystal. With the constants used, the limiting angles within which scattering can take place are about 49′ for Fe and 23′ for Ni. (auth)

9521 THE TIME DISTRIBUTION OF THE GAMMA RADIATION EMITTED IN THE FISSION OF U^{235}. S. Dési, A. Lajtai, and L. Nagy (Central Research Inst., of Physics, Budapest). Acta Phys. Acad. Sci. Hung., 15: 185-92(1962). (In English)

Using a time-to-pulse-height converter of high resolving power, the time distribution of the gamma rays emitted with the thermal fission of U^{235} is determined up to a few nanoseconds. The time distribution of the gamma radiation is found to vary with the gamma energies, such that the time delays with respect to the fission increase with decreasing gamma energies. (auth)

9522 INTERACTIONS OF NUCLEONS WITH HEAVY NUCLEI OF PHOTOGRAPHIC EMULSIONS AT ENERGIES HIGHER THAN 10^{12} ev. J. Gierula, R. Hołyński, and M. Mięsowicz (Inst. of Nuclear Research, Krakow and Academy of Mining and Metallurgy, Krakow). Acta Phys. Polon., 22: 329-34(Oct. 1962). (In English)

The angular distribution of secondary particles of 14 jets with primary energy higher than 10^{12} ev characterized by high evaporation and very high multiplicity ($N_h > 8$, $n_s > 40$) was analyzed. It was found that in central collisions of nucleons with heavy nuclei of photographic emulsion, there is a very significant effect of double maximum angular distribution. The double maximum structure becomes more pronounced with increasing anisotropy of angular distribution. In jets with very well separated narrow and diffuse cones, there is an anisotropy in number and shape of both cones. These facts can be explained on the basis of the two-center model taking into account the secondary interactions of particles created in the "slow center" with the target nucleus. (auth)

9523 ON THE RADIATION OF A MOVING MAGNETIC DIPOLE. Andrzej Białas (Jagellonian Univ., Krakow). Acta Phys. Polon., 22: 349-62(Oct. 1962). (In English)

Starting from the formulas for the electromagnetic potentials of a magnetic dipole in motion, the well-known formula for the radiation of a moving charged body is generalized for the case of one possessing a magnetic dipole moment in addition to charge. In deriving the results, retarded potentials were applied. The formulas obtained were applied for computing the radiation in the following three cases: that of a body at rest, of one participating in hyperbolic motion, and of uniform motion along a circular path. In the first case, the result is found to agree with the well-known formulas for magnetic dipole radiation (Rubinowicz-Blaton 1932). (auth)

9524 STUDIES OF NUCLEAR STRUCTURE BY ELECTRON-GAMMA DIRECTIONAL CORRELATION AND COINCIDENCE MEASUREMENTS. Mohamed Saad Ahmed El-Nesr. Acta Univ. Upsal., No. 10, 15p.(1962).

Theoretical aspects of electron-gamma correlation and coincidence properties are outlined. The effects of nuclear penetration on the internal conversion correlations are discussed. (T.F.H.)

9525 SHIELDING EFFECTS OF U^{238} ON THE RESONANCE ABSORPTION OF U^{235}. T. V. Golashvili and I. M. Kisil'. At. Energ. (USSR), 13: 435-9(Nov. 1962). (In Russian)

The problem of mutual interaction of the neutron resonance absorption of U^{238} and U^{235} under conditions of volume absorption was examined. In view of the closeness of the resonance levels of the 2 isotopes to each other the effect of the U^{238} levels must be taken into account when natural or partially enriched fuels are used; otherwise the calculated effective resonance absorption integral of the neutrons in U^{235} will be too large. The effect was calculated for metallic natural U and for the metal enriched to 10% in the epithermal energy range at 300°C. Experiments were also carried out in the U–graphite reactor, using metallic U enriched to 2% as fuel in a square lattice. The measurements were made only in those regions of the natural U slugs in which the surface absorption of resonance neutrons in U^{238} could be neglected, taking only the volume absorption effect into consideration. The experimentally obtained shielding coefficient $K^{\delta(\delta)}_{shield.}$, equal to 0.88 was somewhat higher than the calculated value of 0.76; this was due to the fact that all the neutrons with energies higher than 0.4 ev were taken into account. (TTT)

9526 DEPENDENCE OF THE TOTAL KINETIC ENERGY OF FISSION PRODUCTS ON THE ENERGY OF THE BOMBARDING NEUTRONS. S. S. Kovalenko, K. A. Petrzhak, and V. M. Adamov. At. Energ. (USSR), 13: 474-5(Nov. 1962). (In Russian)

Consideration of fission product energies indicated that the kinetic energy increases with increasing energy of the bombarding particles in case of symmetric fission. In order to ascertain the validity of this assumption, the kinetic energy of fission products resulting from the fissioning of U^{235} by thermal and 14.5-Mev neutrons was measured, making use of a previously described method of the authors (Zhur. Eksptl'. i Teoret. Fiz. 42: 1475(1962) No. 6). Results revealed a great difference in the energy dependence of the excitation energy of the fissioning nuclei for symmetric and assymetric fission phenomena, confirming the existence of 2 types of fissions as proposed by H. Levy et al., (Phys. Rev. 124: 544(1961)) on the basis of radiochemical data. (TTT)

9527 NEUTRON YIELDS FOR NITROGEN, OXYGEN, AIR AND WATER UNDER THE INFLUENCE OF α-PARTICLES FROM RADIUM-C'. G. V. Gorshkov, V. A. Zyabkin, and O. S. Tsvedkov. At. Energ. (USSR), 13: 475-6(Nov. 1962). (In Russian)

The yield of neutrons originating from the bombardment of liquid N_2 and O_2, air and water by the α-particles of Po^{214} prepared by precipitating the residue from a Rn-filled ampoule on a Pt electrode, was investigated by measuring the neutron activity. The energies and the reaction thresholds of N^{14}, N^{15}, O^{16}, O^{17}, and O^{18} were determined previously. The nitrogen contained 2% O_2 while the N_2 impurity in the oxygen amounted to 0.8%. The yield data were tabulated on the basis of 10^6 α particles from Po^{214}. An empirical formula was derived correlating the energy dependence of the neutron yield Q, expressed in units of $n/10^6$ α particles: $Q = 6.36 \times 10^{-4} E^{5.58}$. The neutron yield for neutrons originating from the (α,n) reaction in O_2 amounted to $0.12n/10^6$ α particles. (TTT)

9528 MEASUREMENT OF THERMAL NEUTRON SPECTRA IN BORIC ACID SOLUTIONS. E. Ya Doil'nitsyn and A. G. Novikov. At. Energ. (USSR), 13: 491-3(Nov. 1962). (In Russian)

Contradictory data are reported in the literature on the thermal neutron spectra of aqueous solutions containing an absorber. This problem was studied by exposing boric acid solutions in water to the neutron beam of the Graphite–Water Reactor. The experimental results were found to agree well with the as yet unpublished theoretical values, calculated by G. I. Marchuk et al., on the basis of the slow neutron scattering model (Atomnaya Energiya 13: (1962) No. 6). A chopper with a 256-channel time-of-flight analyzer was used for studying the 1.5 and 2.9 barn/H atom solutions. In the thermal region the experimental curves followed a Maxwellian distribution with a neutron gas temperature $T_n = (333 \pm 15)°K$ for pure water, $(358 \pm 15)°K$ for the 1.5 barn solution and $(382 \pm 15)°K$ for the 2.9 bar solution at a water temperature of $T_0 = 320°K$. The small surplus of resonance neutrons found in the tests, as compared with the theoretical values, did not affect the determination of the neutron gas temperature. (TTT)

9529 THE $S^{32}(n,p)P^{32}$ REACTION AS A FAST-NEUTRON FLUX MONITOR. D. C. Santry and J. P. Butler (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem., 41: 123-33(Jan. 1963). (AECL-1648)

An extensive study was made of the use of sulfur as a monitor for neutrons with energies from 2 to 20 Mev. Irradiated disks of pressed sulfur were burnt before counting to increase the efficiency and reproducibility of determining the P^{32} activity. It was established that on burning irradiated sulfur $95.5 \pm 0.5\%$ of the P^{32} activity is retained with a reproducibility of $\pm 1.0\%$. Measurements of relative cross sections for the $S^{32}(n,p)P^{32}$ reaction were extended to 20.3 Mev using the $T(d,n)He^4$ and $D(d,n)He^3$ reactions to produce monoenergetic neutrons. Neutron production using Zr–T targets was examined as was the effect of extraneous neutrons from the D(d,np)D process on the $S^{32}(n,p)$ reaction. (auth)

9530 H^4 DISCOVERED AT THE FRASCATI LABORATORIES. Comit. Nazl. Energia Nucl., Notiziario, 8: No. 12, 85(Dec. 1962). (In Italian)

Hydrogen-4 was identified in the reaction $\gamma + He^4 \rightarrow \pi^+ + H^4 \rightarrow n + H^3$ in a course of experiments conducted with a pressure diffusion chamber exposed to the beam of an electron synchrotron. (P.C.H)

9531 ALPHA SPECTROGRAPHY OF RADIUM-224 AND ITS DERIVATIVES. Robert J. Walen. Compt. Rend., 255: 1604-5(Oct. 1, 1962). (In French)

The magnetic α spectra of Ra^{224} show several new rays of low intensity attributable to Po^{216} (one ray), Rn^{220} (1 or 2 rays), and Ra^{224} itself (3 rays). The α energies of some derivatives of Ra^{225} were determined by direct comparison. (tr-auth)

9532 MEASUREMENT OF THE DOPPLER EFFECT IN THE RESONANCE INTERACTION OF SLOW NEUTRONS WITH THE NUCLEI OF A CRYSTAL AT LOW TEMPERATURES. Clément Le Pipec, André Michaudon, and Pierre Ribon. Compt. Rend., 255: 1913-15(Oct. 15, 1962). (In French)

The 78.3-ev resonance of gold and the 7.62-ev resonance of tungsten were measured by time-of-flight methods. The metallic samples of the gold and tungsten were taken successively to room, liquid nitrogen, and liquid helium temperatures. The results confirm the Lamb theory. However, an anomaly is obtained for the tungsten Debye temperature at 77°K. A formula based on the Zemach and Glauber formalism is given and its application is discussed. (tr-auth)

9533 EXCITED ENERGY LEVEL SCHEME OF PROTACTINIUM-234. Roger Foucher, Jan Mérinis, Alceu de Pinho, and Manuel Valadares (CNRS, Orsay,

France). Compt. Rend., 255: 1916-18(Oct. 15, 1962). (In French)

The studies reported in the last several years on the β, internal conversion electron, and γ spectra were analyzed. These analyses, together with recent evidence of a supplementary radiation, indicate a symmetrical level scheme which is shown graphically. The mean life and nature of the excited levels were calculated. (J.S.R.)

9534 A CONTRIBUTION TO DIRECT PROCESSES IN THE $Co^{59}(p,n)$ REACTION FOR $E_p \sim 6.5$ Mev. M. Rozkoš and Z. Vintr (Faculty of Technical and Nuclear Physics, Prague). Czech. J. Phys., 12: 807-14(1962). (In English)

Nuclear emulsions were used to study the energy spectrum and forward-backward asymmetry of neutrons from the $Co^{59}(p,n)$ reaction for $E_p \sim 6.5$ Mev. It was found that the decay of the compound nucleus made a maximum contribution of 50% to the reaction yield. Energies of some excited states of the Ni^{59} nucleus were also determined. (auth)

9535 HOW DO PARTICLES PASS THROUGH THE POTENTIAL BARRIER IN THE TUNNEL EFFECT? L. Dunajský. Czech. J. Phys., 12: 870-2(1962). (In Russian).

The analogy of the tunnel effect and the disturbance of integrated reflection in optics was analyzed for the case in which the normal pointing vector component of the incident and reflecting wave is equal to zero. (R.V.J.)

9536 THE MÖSSBAUER EFFECT ON IMPURITY NUCLEI AT LOW TEMPERATURES. I. P. Dzyub and A. F. Lubchenko (Inst. of Physics, Academy of Science, Ukrainian SSR). Dokl. Akad. Nauk SSSR, 147: 584-7 (Nov. 21, 1962). (In Russian)

It is possible to vary the Mössbauer intensity of a γ emitter by dissolving the activity in various solid solutions. In order to avoid solving the complex dynamic problem of the lattice vibrations, the Mössbauer effect is considered at low temperature ($T < 20°K$) for dilute alloys. Only the ratio of the masses of the impurity atoms and of the solvent atoms is taken into account for the sake of simplicity. The Hamiltonian describing the vibration of the lattice of a solid solution is written in terms of the Hamiltonian of an ideal lattice of solution atoms and a momentum operator. At low temperatures the Mössbauer factor is given by the following expression: $f = \exp[-(3R/2\epsilon_0)\,\phi(\mu)]$. Here $R = (\chi^2\hbar/2m)$, $\epsilon_0 = \hbar\omega_{max}$, and μ is the ratio of the mass of the solution atoms to the solute atoms (M/m). The value of the function $\phi(\mu)$ drops rapidly with increasing value of M/m, and the Mössbauer factor also drops. Thus, in order to increase the intensity of a narrow γ-line without a phonon, the mass of the solution atoms should be as large as possible, and the Debye temperature of the solution atoms should be large. (TTT)

9537 K—CONVERSION COEFFICIENTS OF SOME E2 TRANSITIONS. A. Foglio and M. Mandelli Bettoni (CESNEF, Milan). Energia Nucl. (Milan), 9: 677-80(Dec. 1962). (In English)

The K conversion coefficients of E2 transitions in Er^{166}, Hf^{176}, Os^{186}, and Os^{188} were measured by using a scintillation spectrograph and coincidences techniques. All isotopes belong to the highly deformed nuclei region. The experimental values are higher than the theoretical ones. (auth)

9538 RECENT RESULTS ON NUCLEAR RESEARCH. U. Facchini (CISE, Milan and Università, Milan). Energia Nucl. (Milan), 9: 699-708(Dec. 1962). (In Italian)

The most recent results of the research on the mechanism of the nuclear reactions are the subject of the lecture delivered by the author at a meeting of the Società Lombarda di Fisica (Milan) on October 29, 1962. The integral text of the lecture is given. (auth)

9539 APPLICATIONS OF RECTANGULAR COMPLEX POTENTIAL FOR ELASTIC PROTON SCATTERING AT 1 TO 40 Mev. L. S. Sokolov and I. N. Lebkova (Inst. of Scientific Research, Tomsk Polytechnic Inst., USSR). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 4, 62-5(1962). (In Russian)

A simple complex potential was used for describing $He^4(p,p)$ scattering at 1 to 40 Mev, and comparisons are made of theoretical and experimental data on proton cross sections at 7.5, 17.84, 39.8, and 1.49 Mev. The results showed a satisfactory complex potential interpretation at 7.5 to 18 Mev. Discrepancies are quite obvious at energies above 18 Mev and below 7 Mev. Parameter correlations for the $He^4(p,p)$ scattering potential, $V_0 = -(32)$ to (42) Mev and $W_0 = -(5)$ to (3) Mev (V_0 and W_0 are the real and imaginary parts of the potential, respectively), correspond to proton and neutron scattering on heavy and medium nuclei and show that V_0 for proton scattering on light nuclei coincides with V_0 for proton and neutron scattering on heavy nuclei while W_0 is somewhat smaller. That is in good agreement with data on proton and neutron cross section variations with target mass. Thus it is shown that an optical model can also describe proton scattering on light nuclei. (R.V.J.)

9540 EXPERIMENTAL ESTIMATE OF α PARTICLE MEAN HALF-LIFE INSIDE OF A NUCLEUS. Yu. I. Serebrennikov (Moscow State Pedagogical Inst.). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 4, 151-3(1962). (In Russian)

The mean life τ_α of an alpha particle in the nucleus was evaluated using the bond between the energy distribution of knock-out N(E) and τ_α particles: $N(E) = f(E)P(E) \exp\{-[(M_\alpha)/2(E+U)]^{1/2} \cdot (l/\tau_\alpha)\}$, and the data show that the knock-out α particles in the proton bombardment of C, N, and O at 660 Mev are emitted only at $E_\alpha > 8$ Mev U (U is the Coulomb height). The above approximation showed $\tau_\alpha \approx 4 \times 10^{-23}$ sec. A considerable variation was anticipated between evaluations considering the nuclear diffusion boundary and using a general ratio: $N(E) = f(E)P(E) \exp[-t(E)/\tau_\alpha]$ (where f(E) is the distribution of α particle recoil on positive E inside the nucleus, P(E) is Coulomb barrier α particle penetrability; t(E) is time within the nucleus). (R.V.J.)

9541 HARD CORE PRODUCED BY ORTHOGONALITY CONSTRAINTS. S. Tani and D. A. Uhlenbrock (New York Univ., New York). J. Math. Phys. (N. Y.), 3: 1161-70(Nov.–Dec. 1962).

It is shown that the effect of a hard core as an external force can be reproduced by requirements of orthogonality along. A fictitious orthonormal set of functions is introduced that forms a complete set in the domain occupied by the hard core. The actual wave function is constructed as the eigenfunction of a modified kinetic energy operator, and is required to be orthogonal to all members of the fictitious set. The limit of infinitely many constraints is discussed. It turns out to be impossible to regard the hard-core effect as equivalent to some kind of "potential" acting on free waves (for which the Hamiltonian would be well-defined). However, the eigenfunction is well-defined in the limit of infinitely many constraints, and is independent of the way in which the fictitious set is chosen. (auth)

9542 AVERAGE CROSS SECTION OF THE $^{32}S(n,p)^{32}P$ AND $^{27}Al(n,\alpha)^{24}Na$ REACTIONS FOR FISSION NEUTRONS. H. Depuydt and M. Neve de Mevergnies (Studiecentrum voor Kernenergie, Mol, Belgium). J. Nucl. Energy, Pts. A & B, 16: 447-53(Sept. 1962).

The main purpose of this work was to improve the experimental value $\bar{\sigma}$ of the $S^{32}(n,p)P^{32}$ reaction cross section

for a fission neutron spectrum. The sample in a cadmium box was centered on the axis of an enriched uranium disk irradiated by a thermal neutron beam. The absolute value of the thermal flux was determined by activation of a gold detector. The absolute value of the fast flux at the sample was calculated taking into account the detector-uranium geometry. The average cross section $\bar{\sigma}$ was deduced from an absolute measurement of the sample activity. The results are: for $S^{32}(n,p)P^{32}$: $\bar{\sigma} = 65 \pm 3$ mb, for $Al^{27}(n,\alpha)Na^{24}$: $\bar{\sigma} = 0{\cdot}63 \pm 0{\cdot}03$ mb. (auth)

9543 DECAY OF A NEW NUCLEIDE PROMETHIUM 153. K. Kotajima (Univ. of Tokyo). Nucl. Phys., 39: 89-94(Dec. 1962).

Promethium-153 was investigated from the $Sm^{154}(\gamma,p)Pm^{153}$ reaction induced by 20-Mev bremsstrahlung. The activity was measured with beta and gamma scintillation spectrometers. The half life of this nuclide was found to be 5.5 ± 0.2 min, and the end point energy of the beta ray was found to be 1.65 ± 0.05 Mev. Gamma rays of 0.125 and 0.180 Mev were also observed. The decay energy of this nuclide was found to be substantially lower than expected from a value extrapolated from the beta-decay energy systematics. (auth)

9544 SATELLITES IN THE K-LL AUGER SPECTRA OF $_{53}I^{125}$ AND $_{52}Te^{125}$. R. L. Graham, I. Bergstroem, and F. Brown (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nucl. Phys., 39: 107-23(Dec. 1962).

Using mass-separated sources of Xe^{125}, the K-LL Auger spectra of I^{125} and Te^{125} have been studied with an iron-free β spectrometer set for resolutions of 0.05 to 0.1% in momentum. In both cases an eight-line spectrum is observed. The $K\text{-}L_{II}L_{II}(^3P_0)$ line is not resolved from the $K\text{-}L_IL_{III}(^3P_1)$ line and its nearby satellite, the $K\text{-}L_IL_{III}(^3P_2)$ line; these three lines appear as a partially resolved doublet. The experimental results provide evidence for the $K\text{-}L_{II}L_{II}(^3P_0)$ and $K\text{-}L_{III}L_{III}(^3P_0)$ satellite lines predicted by nonrelativistic theory. It is concluded that the K-LL Auger spectrum has nine lines in all and that the coupling between the two L-shell vacancy states is intermediate rather than pure j-j. The experimental K-LL Auger line intensities for $29 \leqq Z \leqq 94$ are summarized and compared with theoretical predictions. (auth)

9545 ANGULAR CORRELATION MEASUREMENTS IN Mo^{96}. L. Simons (Univ. of Helsinki, Finland), R. E. Holland, G. Wendt, E. Spring, L. Kaeld, and E. Hagebo. Nucl. Phys., 39: 130-8(Dec. 1962).

The angular correlation of gamma transitions in Mo^{96} following the decay of Nb^{96} was studied. It proved possible to assign the following spins and parities: 1610 kev, 2^+ or 4^+; 1850 kev, 4^+; 1960 kev, 3^+; and 2410 kev, 3^-. (auth)

9546 INELASTIC SCATTERING OF DEUTERONS FROM STRONTIUM AND YTTRIUM. E. W. Hamburger (Universidade de São Paulo, Brazil). Nucl. Phys., 39: 139-46(Dec. 1962).

Targets of natural Sr and Y are bombarded with 15-Mev deuterons. Scattered particles are magnetically analyzed and detected in nuclear emulsions. Angular distributions between 25 and 85° are obtained for the deuterons corresponding to Sr^{88} levels at 1.835 and 2.74 Mev. Other Sr levels are observed at 0.85 Mev (probably the 0.869-Mev level of Sr^{87}), 1.11 ± 0.02 Mev (probably the 1.080-Mev level of Sr^{88}), 3.20 ± 0.05, 3.61 ± 0.025, 4.02 ± 0.025, and 4.27 ± 0.03 Mev. Y exposures are made at 30, 60, and 85°. The following levels of Y^{89} are observed: 1.510 ± 0.010, 1.742 ± 0.010, 2.227 ± 0.010, 2.533 ± 0.015, 2.886 ± 0.015, 3.135 ± 0.020, 3.74 ± 0.02, 4.02 ± 0.03, 4.20 ± 0.03, 4.34 ± 0.03, 4.49 ± 0.03, and perhaps 4.79 ± 0.04 Mev. (auth)

9547 THE DECAY OF Eu^{146}(4.7d) TO Sm^{146}. E. G. Funk, Jr., J. W. Mihelich, and C. F. Schwerdtfeger (Univ. of Notre Dame, Ind.). Nucl. Phys., 39: 147-59(Dec. 1962). (TID-16277)

The electron-capture and positron decay of 4.7-day Eu^{146} to levels in Sm^{146} is investigated with scintillation counters, magnetic spectrometers, and coincidence and directional-correlation techniques. The complex gamma spectrum extends to 2940 kev, with the most prominent transitions being those of 635, 667, 704, 749, 902, 1061, 1300, and 1536 kev. Conversion electrons are studied with permanent-magnet spectrographs and an intermediate-image spectrometer. Levels in Sm^{146} are established at the following energies: 749 (2+), 1384 (4+, 3−), 2051, 2286, 2684, 3160, 3202, and 3464 kev. A number of less certain levels are postulated on the basis of energy and intensity considerations. Positron branches of 2107, 1466, and 798 kev proceed to levels at 749, 1384, and 2051 kev, respectively. Directional-correlation measurements are carried out on the 635-749 kev gamma cascade, but the results are ambiguous. A tabulation of energy-level data for the region of neutron number 82 to 88 is presented. (auth)

9548 LEVELS INVOLVING A $(d_{\frac{5}{2}})^3_{\frac{5}{2}}$ STATE IN LIGHT NUCLEI. B. G. Harvey, J. Cerny, R. H. Pehl, and E. Rivet (Univ. of California, Berkeley). Nucl. Phys., 39: 160-8 (Dec. 1962). (UCRL-10190)

The two-nucleon (α,d) stripping reaction is studied for targets of C^{12}, N^{14}, N^{15}, and O^{16}. In each case, strong levels believed to correspond to insertion of the captured nucleons into a J = 5 state of a $(d_{\frac{5}{2}})^2$ configuration are observed. In N^{14} and F^{18}, single levels are observed at 9.0 and 1.1 Mev, respectively; in O^{16} and O^{17} the level is split into a triplet (O^{16}) and a doublet (O^{17}) by coupling with the spin of the target core. In O^{16} the levels lie at 14.7, 16.2, and 17.2 Mev; in O^{17}, they are at 7.6 and 9.0 Mev. By inelastic helium ion scattering the following parities are measured for levels in N^{14}: 3.95 and 7.03 Mev, positive; 4.91, 5.10, 5.69, and 5.83 Mev, negative. (auth)

9549 14 GAMMA SPECTRA OF SHORT-LIVED NUCLIDES. Minoru Okada (Government Chemical Industrial Research Inst., Tokyo). Nucleonics, 20: 61-2 (Dec. 1962).

Gamma spectra are presented for the following short-lived nuclides: Sb^{122m}, Ca^{49}, Er^{167m}, Au^{197m}, Li^9, Mg^{27}, Ne^{23}, N^{16}, Pd^{109m}, Rb^{86m}, Sn^{125m}, W^{185m}, Yb^{177m}, and Y^{89m}. (R.J.S.)

9550 NEW VALUES FOR HALF-LIVES OF Cs^{137} AND Co^{60} NUCLIDES. Steven G. Gorbics, Walter E. Kunz, and Albert E. Nash (Naval Research Lab., Washington, D. C.). Nucleonics, 21: No. 1, 63-4; 67(Jan. 1963).

Measurement of the long half life of Cs^{137} as well as that of Co^{60} is made by determining the ratio of Cs^{137} and Co^{60} activity to the activity of a radium source. Data give half lives of 29.68 ± 0.05 yr and 5.263 ± 0.003 yr, respectively, for Cs^{137} and Co^{60}. (D.C.W.)

9551 π^0−MESON PRODUCTION IN 8.4 Gev/C π^-−XENON NUCLEUS COLLISION. Oleg Czyzewski and Jerzy Loskiewicz (Inst. of Nuclear Research, Polish Academy of Sciences, Krakow). Nukleonika, 7: 435-43 (1962). (In English)

Inelastic interactions of 8.4-Bev/c π^- mesons with Xe nuclei are studied in a Xe bubble chamber. The energy spectrum and the angular distribution of secondary photons are measured. The possibility is shown of correlating photon pairs with individual π^0 mesons. The energy spectrum of π^0 mesons consists of a low energy part up to 0.6 Bev and a high energy tail. The mean transverse momentum is (0.36 ± 0.04) Bev/c. (auth)

9552 SYNTHESIS OF ^{256}Md DURING IRRADIATION OF ^{238}U BY ^{22}Ne IONS AND INVESTIGATION OF SOME OF ITS CHEMICAL PROPERTIES. H. Beranova, J. Brandstetr, V. Druin, V. Ermakov, T. Zvarova, M. Krzhivanek, Ya. Maly, S. Polikanov, Hung-kuei Su. Nukleonika, 7: 465-71 (1962). (In Russian)

In bombarding U^{238} by Ne^{22}, Md^{256} is obtained. The distribution coefficient of Md for ammonium lactate, α-hydroxyisobutyrate, and citrate is found by means of the chromatographic separation of actinide elements and rare earths on Dowex-50. (auth)

9553 THE CROSS-SECTION OF $^{256}_{101}$Md SYNTHESIS BY IRRADIATION OF $^{238}_{92}$U AS A FUNCTION OF ENERGY OF $^{22}_{10}$Ne IONS. V. A. Druin. Nukleonika, 7: 473-8(1962). (In Russian)

By bombarding a stack of uranium targets with Ne^{22} ions and observing fragments from the spontaneous fission of Fm^{256} with Si–Au detectors, the energy dependence of the production cross section of Md^{256} is investigated in the neon energy range from 110 to 150 Mev. The maximum cross section (at a neon energy of 130 Mev) is found to be 2×10^{-33} cm^2. (auth)

9554 CALCULATION OF THE LITHIUM ATOM IN THE ADIABATIC APPROXIMATION AND COMPUTATION OF ITS NUCLEAR MAGNETIC MOMENT. M. G. Veselov and I. B. Bersuker. Opt. Spectr. (USSR) (English Transl.), 13: 167-9(Sept. 1962).

A calculation is presented of the lithium atom in the adiabatic approximation, in which the polarization effect of the optical electron on the shell and the counter-effect of this polarization on the optical electron are automatically taken into account. The wave function of the internal 1s electron turns out to be deformed and dependent on the position of the optical electron as a parameter, and a "mirror force" potential enters naturally into the equation for the optical electron. The latter is integrated over the states 2s, 2p, and 3p. One of the advantages of the method is a marked improvement in the behavior of the wave function near zero. This behavior permits a computation of the magnetic moment of the Li^7 nucleus, which is in agreement with experimental data. (auth)

9555 OPTICAL ALIGNMENT OF RUBIDIUM ISOTOPES. E. B. Aleksandrov. Opt. Spectr. (USSR) (English Transl.), 13: 250-1(Sept. 1962).

The reduction in intensity of an orienting light signal from a natural Rb^{85}–Rb^{87} mixture, as the signal passes under resonance conditions through an absorption cell that contains a Rb mixture of the same isotopic composition, is measured. The measurements are made at 35 to 90°C. The absorption signals for the two isotopes are measured as functions of the pressure and temperature, and are used as indicators of the optical orientation induced in the two isotopes in the absorption cell. (T.F.H.)

9556 ERICSON FLUCTUATIONS IN THE $Si^{28}(n,\alpha)Mg^{25}$ REACTION. L. Colli, I. Iori, M. G. Marcazzan, and M. Milazzo (Laboratori C.I.S.E., Milan). Phys. Letters, 2: 12-14(Aug. 1, 1962). (In English)

The $Si^{28}(n,\alpha)Mg^{25}$ reaction is studied in the energy interval from 12.15 to 18.4 Mev. Measurements of the cross section for the transition to the first excited states of the residual nucleus have been obtained through detecting the energy spectra of the products of the reaction at intervals of 50 kev–15 Mev, 100 kev–17 Mev, and 150 kev–18.4 Mev. The characteristic fluctuations of the cross sections are discussed. (H.D.R.)

9557 SCATTERING OF 9 Mev GAMMA RAYS BY THE NUCLEAR ELECTROMAGNETIC POTENTIAL (DELBRÜCK SCATTERING). R. Boesch, J. Lang, R. Mueller, and W. Woelfli (Eidgenossische Technishe Hochschule, Zurich). Phys. Letters, 2: 16-17(Aug. 1, 1962). (In English)

A gamma ray scattering experiment was carried out using the reaction Ni(n,γ) to produce 8.998 Mev quanta with a flux of 10^7 per sec per cm^2. Scattered gamma rays were detected in a scintillation crystal, and by pulse height analysis the elastic component was separated from the inelastic. The measured scattering cross section is shown for the elastic scattering in lead and uranium, and the nuclear Thomson plus Rayleigh effect and Delbrück effect are calculated for Pb. (H.D.R.)

9558 PRODUCTION OF VERY SLOW PIONS BY 9 Gev PROTONS ON EMULSION NUCLEI. E. M. Friedlaender (Inst. of Atomic Physics, Bucharest). Phys. Letters, 2: 38-40(Aug. 1, 1962). (In English)

The energy spectra and angular distribution of slow pions produced in NIKFI-R emulsion by a 9-Bev proton beam were studied. The production of slow pions is found to be independent of the target nucleus and characteristic for the elementary nucleon-nucleon interaction. The properties of positive and negative slow pions are compared, and observation of eight cases of "sub-barrier" (energy below the Coulomb barrier) positive slow pions is reported. The results strongly indicate that at least part of the slow pions are not emitted from within the parent nuclei, but are "vehiculated out" by unstable systems that decay into pions just outside the nucleus. (H.D.R.)

9559 ELECTROMAGNETIC TRANSITIONS 8.88 Mev → 6.06 Mev IN O^{16}. S. Gorodetzky, P. Mennrath, W. Benenson, P. Chevallier, F. Scheibling, and G. Sutter (Institut de Récherches Nucléaires, Strasbourg). Phys. Letters, 2: 43(Aug. 1, 1962). (In French)

The branching ratio for the decay of the 8.88-Mev level to the 6.06-Mev level as compared with the direct decay to the ground state is measured as R(8.88 Mev → 6.06 Mev/8.88 Mev → 0 Mev) = $(1.20 \pm 0.36) \times 10^{-2}$. The 8.88 Mev → 6.06 Mev → 0 Mev cascade is detected by triple coincidence counting of the 2.82-Mev gamma ray to the 6.06-Mev level along with the electron pair produced by the 6.06-Mev monopole transition to the ground state. (T.F.H.)

9560 STUDY OF THE (p,pd) REACTIONS ON Li^6 AND Li^7. C. Ruhla, M. Riou, J. P. Garron, J. C. Jacmart, and L. Massonnet (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). Phys. Letters, 2: 44-7(Aug. 1, 1962). (In French)

Angular correlation distributions are measured for the reactions Li^6(p,pd), Li^7(p,pd), and Li^7(p,pt) and are compared with those observed for D(p,pd) and D(p,2p). The results indicate that there is a high probability for the existence of a deuteron inside the Li^6 nucleus, but not inside the Li^7 nucleus. The existence of a triton inside the Li^7 nucleus is also found to be doubtful. (T.F.H.)

9561 DYNAMIC POLARISATION IN A THREE-SPIN SYSTEM. K. H. Hausser and F. Reinbold (Max-Planck-Institut, Heidelberg). Phys. Letters, 2: 53-4(Aug. 1, 1962). (In English)

The dynamic polarization due to the Overhauser effect in a system of three spins S, I_1, and I_2 was observed using double and triple resonance techniques. Measurements were made on the signal enhancement of the nuclear magnetic resonance of the C^{13}-nuclei (I_2) of the solvent in natural abundance in a solution of the free radical 1,3-bis-diphenylene-phenyl-allyl in benzene and perdeuterobenzene while saturating the electron (S) and both the electrons and the protons simultaneously. This system is used to calcu-

late theoretically in first approximation the interaction between the electrons and protons, neglecting the comparatively small numbers of the C^{13}-spins, and in second approximation the polarization of the C^{13}-spins due to their interaction with the electrons and with the protons. (H.D.R.)

9562 ON THE 22 kev STATE OF Sm^{149}. S. Jha, R. Segnan, and G. Lang (Carnegie Inst. of Tech., Pittsburgh). Phys. Letters, 2: 117(Sept. 1, 1962). (In English)

The low energy gamma spectrum and decay scheme of a Eu^{149} source and the transmission through a Sm^{149} absorber as a function of source velocity are presented. The occurrence of resonant absorption shows that at least part of the 22-kev radiation results from a transition to the ground state. A lower limit to the actual mean life of the state is 4×10^{-9} seconds. Assuming M1 transition, the total conversion coefficient is 12, and the lower limit to mean life against gamma transition is 5×10^{-8} seconds. (H.D.R.)

9563 ENERGY DEPENDENCE OF THE DEUTERON ELASTIC SCATTERING FOR NUCLEI IN THE REGION OF A = 40. A. Strzałkowski (Inst. of Nuclear Physics, Krakow). Phys. Letters, 2: 121-2(Sept. 1, 1962). (In English)

Previous work on the elastic scattering of deuterons on light nuclei indicates that the third maximum of the angular distribution vanishes at lower nuclei mass numbers as deuteron energy is lowered. To investigate this phenomenon, the angular distributions of deuterons elastically scattered on Al, S, Ca, and Ti nuclei were measured for deuteron energies of 9.8, 11.4, 12.1, and 12.8 Mev. The measured differential cross sections are presented relative to Rutherford scattering. (H.D.R.)

9564 ELECTROMAGNETIC TRANSITIONS IN P^{31}. V. K. Thankappan (Physical Research Lab., Agmedabad, India). Phys. Letters, 2: 122-3(Sept. 1, 1962). (In English)

An earlier paper discussed the energy levels of P^{31} on the basis of the weak-coupling unified model. Energy levels from improved calculations are compared with experimental levels. Quantitative predictions of the model for the decay properties of the low-lying levels in P^{31} are discussed, and calculated transition probabilities for the lowest few states in P^{31} are compared to observed values. (H.D.R.)

9565 ON THE ENERGY SPECTRUM OF (p,2p) REACTIONS. K. Dietrich (Universität, Frankfurt am Main). Phys. Letters, 2: 139-42(Sept. 1, 1962). (In English)

Calculations are presented to show that the details of the spectrum of the summed energies of the two emerging protons in (p,2p) reactions are simply related to the configuration mixing of the individual particle shell-model. The summed energy spectra is shown for $Li^6(p,2p)He^5$, $Li^7(p,2p)He^6$, $C^{12}(p,2p)B^{11}$, and $B^{10}(p,2p)Be^9$ reactions, and factors that determine the relative intensity of different peaks corresponding to protons knocked out of the same shell are evaluated and discussed. (H.D.R.)

9566 A D.W.B.A. ANALYSIS OF THE REACTION $Si^{28}(n,p)Al^{28}$. G. Schiffrer (CISE, Milan), A. Agodi, and R. Giordano. Phys. Letters, 2: 144-5(Sept. 1, 1962). (In English)

Preliminary results are given relative to calculations of the angular distribution of the protons from the reaction $Si^{28}(n,p)Al^{28}$ initiated by 14-Mev neutrons and leaving the residual nucleus in its ground state. The calculated angular distribution and experimental points from a previous work are compared and evaluated. (H.D.R.)

9567 STUDIES OF THE (n,α) AND (n,p) REACTION IN Si^{28} AT 14 Mev BY A COINCIDENCE METHOD. J. H. Aitken and W. R. Dixon (National Research Council, Ottawa). Phys. Letters, 2: 152-4(Sept. 1, 1962). (In English)

Reactions induced in Si^{28} by 13.90 Mev neutrons were studied with a triple coincidence arrangement. Pulse height distributions are given for reactions attributed to $Si^{28}(n,p)Al^{28}$, $Si^{28}(n,d)Al^{27}$, and $Si^{28}(n,\alpha)Mg^{25}$, and are compared to the spectrum from a single detector. Cross sections for the transitions to the first four excited states of Mg^{25} are given relative to the cross section for the ground state transition. (H.D.R.)

9568 ROTATIONAL-STATE LIFETIMES. D. B. Fossan and B. Herskind (Univ. of Copenhagen). Phys. Letters, 2: 155-7(Sept. 1, 1962). (In English)

The half lives of the 2^+ first excited states of W^{180} and Hf^{180} have been measured as $(1.33 \pm 0.05) \times 10^{-9}$ and $(1.50 \pm 0.04) \times 10^{-9}$ sec, respectively. These results are included in a summary of a complete investigation of the enhancement of the $2^+ \rightarrow 0^+$ internal-conversion process for deformed nuclei, in which half lives of 2^+ first rotational levels were measured for a series of even-even nuclei ($150 < A < 190$). The summary includes calculated experimental total conversion coefficients and the corresponding theoretical total conversion coefficients for comparison. (H.D.R.)

9569 MAGNETIC FORM-FACTORS BY 180° ELECTRON SCATTERING. G. A. Peterson (Stanford Univ., Calif.). Phys. Letters, 2: 162-3(Sept. 1, 1962). (In English)

Elastic magnetic scattering peaks resulting from the scattering of 41.5-Mev electrons through 180° are shown for Li^6 and Li^7. Cross sections are $(4 \pm 2) \times 10^{-32}$ and $(5.8 \pm 0.4) \times 10^{-32}$ cm^2/sr for Li^6 and Li^7, respectively. The factors that possibly contribute to the scattering and the usefulness of magnetic form-factor curves are discussed. (H.D.R.)

9570 SOME PREDICTIONS OF THE CLUSTER MODEL OF NUCLEAR FISSION. H. Faissner (CERN, Geneva) and K. Wildermuth. Phys. Letters, 2: 212-14(Oct. 1, 1962). (In English)

The unified viewpoint provided by the cluster model of nuclear fission is used to predict mass distributions using the observed minima in the excitation energies of fragments and to calculate angular distributions from the mass yield curves. The mass distribution in thermal neutron induced fission of U^{235} is calculated, using certain assumptions for asymmetric fission, and is found to be in good agreement with experiment. The relative contribution of asymmetric fission to the observed yield in Th^{232} at 2 Mev is shown as a function of fragment mass after neutron emission, and the mass dependence of the anisotropy at 2.2 Mev is given assuming symmetric fission is isotropic. (H.D.R.)

9571 LONGITUDINAL POLARISATION OF BETA ELECTRONS FROM Pm^{147}. V. G. Kulkarni, C. V. Panat, and V. B. Thosar (Tata Inst. of Fundamental Research, Bombay). Phys. Letters, 2: 228-9(Oct. 1, 1962). (In English)

The longitudinal polarization of beta-electrons from Pm^{147} was measured by the method of Mott scattering. Longitudinal polarization data in the energy range $\beta = v/c = 0.575$ to 0.62 are presented, where $-v/c$ is the degree of longitudinal polarization predicted by the V-A theory of beta-decay interaction. The data show a deviation of 15% from the $-v/c$ rule. (H.D.R.)

9572 MONOPOLE (pn) EXCITATIONS AND ISOBARIC-SPIN SPLITTING OF SINGLE-PARTICLE AND SINGLE-HOLE STATES. J. B. French and M. H. Macfarlane (Univ. of Rochester, N. Y.). Phys. Letters, 2: 255-7(Oct. 1, 1962). (In English)

A difficulty in making direct measurements of the isobaric-spin splitting of single-particle and hole states in pickup and stripping studies is that the $T_>(T_{target} + \frac{1}{2})$ component is unfavored with respect to the $T_<(T_i - \frac{1}{2})$ component by a factor roughly the reciprocal of the neutron excess. A procedure for determining the T-splitting is presented that combines a pickup or stripping experiment for the $T_<$ component with a (p,n) reaction, ending in the same final nucleus, and involving the same orbit of the transferred particle, for the $T_>$ component. In this case the state that is the isobaric analogue of the target state is strongly monopole excited. Estimates of T-splittings of single-hole states from pickup reactions are tabulated for Cr^{51}, Fe^{53}, Zn^{65}, Zn^{67}, and Zr^{89}. Estimates of T-splittings are made for Sc^{49}, and a discussion is presented of conclusions that could be drawn if there were detectable monopole (p,n) transitions to states other than the isobaric-spin analogue of the target ground state. (H.D.R.)

9573 LIFETIME OF THE 7.02 Mev LEVEL IN Ne^{20}. C. Broude, M. A. Clark, and A. E. Litherland (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Letters, 3: 118-20(Dec. 15, 1962). (In English)

The 7.02-Mev level in Ne^{20} was prepared by the reaction $C^{12}(C^{12},\alpha)Ne^{20}$ by way of a prominent resonance at 15.55-Mev C^{12} ion beam bombarding energy. The Doppler shift attenuation method was employed to measure the lifetime of the 7.02 Mev level. It was found that the enhancement of the E2 radiation gives support to the view that this level is the 4− rotational level based on the 2− level at 4.97 Mev, the intrinsic quadrupole moment of this band being the same as that of the ground state band. Preliminary data on the lifetimes of the first three excited levels of Ne^{20} indicate agreement with values previously reported. (H,D.R.)

9574 ON THE SUPERFLUID BEHAVIOUR OF NUCLEAR MATTER. P. Brovetto and V. Canuto (Istituto Nazionale di Fisica Nucleare, Turin). Phys. Letters, 3: 124-5(Dec. 15, 1962). (In English)

Although the main hypothesis in the conventional statistical treatments of nuclei is the independence among the nucleons, there are reasons to believe that this is not the case. The explanation of some effects must be looked for in the influence of some kind of residual interaction among the nucleons. A preliminary investigation of the behavior of nuclear matter when the residual interaction is seen in the B.C.S. scheme is presented. The functions E(T) and $C_v(T)$, where E is the excitation energy and C_v is the specific heat, are plotted versus temperature for both the free particle and superfluid cases, and the effects on E and C_v due to residual interaction are discussed. (H.D.R.)

9575 γ-γ COINCIDENCE MEASUREMENTS ON Re^{189}. P. Blichert-Toft (Chalmers Tekniska Hogskola Göteborg). Phys. Letters, 3: 130-2(Dec. 15, 1962). (In English)

Direct and coincident γ-spectra measurements were made on a rhenium sample prepared from an alpha-bombarded tungsten target. The single γ spectrum of Re^{183}, Re^{184}, and Re^{189} is plotted, and the γ-γ coincidences observed are summarized. Three γ lines at 211, 568, and 671 kev were assumed to originate from the isotope Re^{189}. Its half life is estimated to be about 120 days, and a possible decay scheme for Re^{189} is proposed. (H.D.R.)

9576 A POSSIBLE THREE-PHONON GROUP FROM Ni^{62}. H. W. Broek (Argonne National Lab., Ill.). Phys. Letters, 3: 132-4(Dec. 15, 1962). (In English)

A model that gives a better prediction for the energies of the two-phonon states in nuclei than the simple harmonic oscillator has been proposed by Kerman and Shakin. They have achieved a good fit to the energies of the three two-phonon levels of Ni^{62} in terms of two parameters. An experiment is described in which a collective group was found at the energy predicted by theory for the three-phonon quintet of levels. A Ni^{62} target was bombarded by 43-Mev α particles, and a pulse-height spectrum is shown for α particles scattered at 38°. The three-phonon group energy was computed from the experimental results to be 3.24 ± 0.04 Mev. (H.D.R.)

9577 THE ft VALUE FOR Al^{26} AND THE UNIVERSAL FERMI INTERACTION. J. M. Freeman, J. H. Montague, D. West, and R. E. White (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Letters, 3: 136-8 (Dec. 15, 1962). (In English)

The possibility of a universal Fermi interaction with exact equality of the vector coupling constant (G_V) and the coupling constant inferred from muon decay (G_μ) has led to the conserved vector current hypothesis. To investigate the validity of this hypothesis, the case of the decay of isomeric Al^{26*} to Mg^{26} was examined. Precise Q-value measurements for the reaction $Mg(p,n)Al^{26*}$ yielded the value $Q_{Mg} = -5.0126 \pm 0.0022$ Mev. A half life of 6.374 ± 0.016 seconds was measured for Al^{26*}. Coupling constants and ft values were calculated for Al^{26*} decay and compared to O^{14} decay values. The data are seen to be in agreement within the uncertainties in the theoretical corrections, and the Al^{26*} result thus lends further support to the conserved vector current hypothesis. (H.D.R.)

9578 SEARCH FOR POSITRONS IN THE DISINTEGRATION OF Ag^{110} ISOMERS. D. Berényi (Inst. of Nuclear Research, Hungarian Academy of Sciences, Debrecen). Phys. Letters, 3: 142-3(Dec. 15, 1962). (In English)

A description is given of an experiment to determine the number of positrons present in the decay of Ag^{110}. A source of about 500 μc yielded 7.8 ± 2.7 positrons per hour. This value corresponds to a ratio of $2.6 \pm 1.3 \times 10^{-5}$ positrons per disintegration for the Ag^{110} isomers. Considering that about such a number of positrons is expected to appear only from pair-conversion in transitions higher than 1 Mev between the levels of Cd^{110} in the course of Ag^{110} decay, the number of positrons per disintegration of positive β decay into Pd^{110} can be up to 10^{-5} as a maximum. (H.D.R.)

9579 A MEASUREMENT OF μ^- TOTAL CAPTURE RATE IN He^4. R. Bizzarri, E. Di Capua, U. Dore, G. C. Gialanella, P. Guidoni, and I. Laakso (Università, Rome and Instituto Nazionale di Fisica Nucleare, Rome). Phys. Letters, 3: 151-2(Dec. 15, 1962). (In English)

The total capture rate of μ^- mesons in He^4 has been measured with a slow, high-purity muon beam and a helium bubble chamber. The range spectrum of nuclear recoils is given for the events and compared to recoils from π^- stars. When corrected for π^- contamination, the number of muon captures in the events was determined. The capture rate obtained is 950 ± 90 sec^{-1}, in good agreement with theory. (H.D.R.)

9580 SCATTERING APPROXIMATION FOR LONG-RANGE FORCES. K. R. Greider (Yale Univ., New Haven). Phys. Rev. Letters, 9: 392-6(Nov. 1, 1962)

A scattering approximation is formulated in terms of the individual physical two-body scattering amplitudes. The method appears valid for all particle energies and momentum transfers and requires at least one of the interactions to be long range, making it useful in treating a wide variety of elastic and inelastic scattering problems. The theoreti-

cal arguments are shown to give good agreement with experiments for two different inelastic nuclear processes: the neutron transfer reaction in low-energy ion-ion scattering ($N^{14} + N^{14} \rightarrow N^{13} + N^{15}$) and the high-energy (p,d) pickup process ($p + C^{12} \rightarrow d + C^{11}$). (H.D.R.)

9581 PHOTOPRODUCTION OF π^+ MESONS IN He^4. P. E. Argan (Università, Genoa, and Istituto Nazionale Fisica Nucleare, Genoa), G. Bendiscioli, A. Piazzoli, V. Bisi, M. I. Ferrero, and G. Piragino. Phys. Rev. Letters, 9: 405-7(Nov. 1, 1962).

An analysis of charged pion photo-production on He^4 is made to investigate the existence of H^4 states. A diffusion cloud chamber filled with He^4 was exposed to a 1-Bev γ beam and the $\gamma + He^4 \rightarrow \pi^+ + n + H^3$ events were selected. A sample of 96 events is analyzed. The results indicate the reaction $\gamma + He^4 \rightarrow \pi^+ + [H^4]$; $[H^4] \rightarrow n + H^3 +$ (3.5 to 7) Mev, with a frequency comparable to π^+ photoproduction without the formation of $[H^4]$. (H.D.R.)

9582 TOTAL MUON CAPTURE RATES AND THE UNIVERSAL FERMI INTERACTION. R. Klein and L. Wolfenstein (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. Letters, 9: 408-10(Nov. 1, 1962)

A previous investigation of muon capture by Primakoff expresses the total capture rate for complex nuclei as a function of A and Z in terms of the coupling constants for capture by a proton and a single parameter describing nuclear matter. It is pointed out that the derivation of the Primakoff formula involves unjustified mathematical approximations. His basic approximations are shown to lead to formulas giving a reasonable fit to experimental capture rate data, but the value of the square of the coupling constant needed is twice the universal Fermi interaction (UFI) prediction. Thus, it is concluded that no quantitative verification of UFI has been correctly deduced from the total capture rates on nonlight nuclei. (H.D.R.)

9583 MASS DISTRIBUTION AND KINETICS OF U^{235} THERMAL-NEUTRON-INDUCED THREE-PARTICLE FISSION. H. W. Schmitt, J. H. Neiler, F. J. Walter, and A. Chetham-Strode (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters, 9: 427-9(Nov. 15, 1962).

The mass distribution, mass-energy correlations, and other kinetic parameters were obtained for U^{235} thermal-neutron-induced three-particle fission. The energies of the two heavy fragments and of the third light particle (usually a long-range alpha particle) were measured in coincidence using three-parameter correlation experiment. The mass distributions obtained for particles from binary and ternary fission indicate that the long-range alpha particles are emitted principally at the expense of nucleons in the light fragment for near-symmetric fission and at the expense of nucleons in the heavy fragment for more assymmetric fission. Strong influence of the closed N = 82 and N = 50 shells is indicated. The mass distribution of the heavy fission products is essentially independent of long-range alpha-particle energy. The total fragment kinetic energy averaged over all mass ratios and over all alpha-particle energies is in slight disagreement with the previously reported value for ternary fission. (H.D.R.)

9584 CROSS-SECTION PROBABILITY DISTRIBUTIONS. C. E. Porter (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters, 9: 429-30(Nov. 15, 1962). (BNL-6389)

The notion of cross-section probability distributions is introduced as a natural extension of the optical model concept. The example chosen to clarify this motion is that of the completely soluble "picket fence" model in which the spacings between the widths of fine structure levels are assumed to be constant. The discussion is confined to S waves. The differential cross section probability distribution is shown for various parameter values. From the plot, it is highly probable that the cross section takes on either a minimum or maximum value and not so probable that it will be found between the minimum or maximum values. (H.D.R.)

9585 STATISTICAL DISTRIBUTION OF REACTION WIDTHS. Lawrence Wilets (Univ. of Washington, Seattle). Phys. Rev. Letters, 9: 430-2(Nov. 15, 1962).

Porter and Thomas have previously proposed an analysis of reduced reaction widths which yields a quantity ν interpretable as the number of open decay channels. They give for the scatter in reaction widths the chi-squared distribution function for ν degrees of freedom, $P_\nu(\Gamma) \propto \Gamma^{\frac{1}{2}\nu-1} \exp(-\nu\Gamma/2\langle\Gamma\rangle)$, where ν is an integer. Here the analysis is generalized to include partially open channels or channels of varying width. At the same time a method of analyzing data emerges that is simpler than the usual curve plotting and comparison technique. (H.D.R.)

9586 DIRECT MEASUREMENT OF μ^--MESONIC MOLECULE FORMATION RATES IN LIQUID HYDROGEN. G. Conforto, S. Focardi, C. Rubbia, and E. Zavattini (CERN, Geneva). Phys. Rev. Letters, 9: 432-4(Nov. 15, 1962).

Experimental evidence is presented for 2p–1s transition mesonic x rays of 214-kev from (1) $(\mu,p) + Ne \rightarrow (\mu,Ne) + p$ and (2) $(\mu,d) + Ne \rightarrow (\mu,Ne) + d$ reactions obtained by dissolving neon in deuterium-free hydrogen and deuterium-hydrogen mixtures, respectively. The results indicate that reaction (1), leading to excited states, is compatible with 100% of the cases. The time distribution of these γ rays makes possible a direct measurement of the speed of $(p\mu p)$ and $(p\mu d)$ molecule formation. Rates of mesonic-molecule formation and 2p–1s transition mesonic x-ray yields are tabulated and time distributions of μ^- transfer fractions are shown. (H.D.R.)

9587 PHOTONEUTRON CROSS SECTION OF OXYGEN AND ALUMINUM. L. N. Bolen and W. D. Whitehead (Univ. of Virginia, Charlottesville). Phys. Rev. Letters, 9: 458-60(Dec. 1, 1962).

The absolute (γ,n) cross sections of aluminum and oxygen have been measured using bremsstrahlung from a 70-Mev synchrotron. The $O^{16}(\gamma,n)$ and $Al^{27}(\gamma,n)$ cross sections are plotted to 30 Mev and compared with the resultants of Gaussian curves used to synthesize the cross sections. The values of the parameters of the Gaussian curves used to synthesize the cross sections are tabulated. Theoretical values of the energy at which the maximum cross section occurs (E_m), the dipole absorption strength, and the width at half maximum of the Gaussian curve are given for O^{16}, and values of E_m from a total absorption experiment are given for Al^{27}. (H.D.R.)

9588 BINDING ENERGY OF Λ^0 HYPERONS IN HEAVY HYPERNUCLEI ($60 < A < 100$). D. H. Davis (Univ. of Chicago), R. Levi Setti, M. Raymund, O. Skjeggestad, G. Tomasini, J. Lemonne, P. Renard, and J. Sacton. Phys. Rev. Letters, 9: 464-6(Dec. 1, 1962).

The short-range hyperfragments from 800 Mev/c K^- interactions have been shown to possess mass values in the range A = 60 to 100, and an upper limit of 35 Mev has been placed on the value of their B_Λ. Details are tabulated for five π-mesic decays attributed to hyperfragments of the same order of mass resulting from 0.8 and 1.5 Bev/c K^- interactions in emulsion. From these events, a more precise estimate of the upper limit of B_Λ is set at 25 Mev. (H.D.R.)

9589 PRODUCTION OF UNNATURAL-PARITY STATES BY INELASTIC ALPHA-PARTICLE SCATTERING. W. W. Eidson and J. G. Cramer, Jr. (Indiana Univ., Bloomington). Phys. Rev. Letters, 9: 497-500(Dec. 15, 1962).

Theoretical aspects are considered for the excitation of unnatural-parity states in even-even nuclei by inelastic scattering of spinless particles. An experiment was undertaken to measure the (α,α') differential cross sections of the fourth excited states ($J^{\Pi} = 3^+$) of Mg^{24} and Si^{28} using 22.5-Mev alpha particles. The measured cross sections are shown for the ground states and the fourth excited states of the two nuclei. Approximate differential cross section values are tabulated from the available measurements on unnatural-parity states. The existing evidence on the excitation process shows it most likely proceeds through nonsimultaneous, multiple-phonon excitation and a direct exchange process. The compound nucleus formation and spin-orbit interaction reaction processes do not seem to contribute significantly. (H.D.R.)

9590 EFFECT OF EXCHANGE ON L TO K CAPTURE RATIOS. John N. Bahcall (California Inst. of Tech., Pasadena). Phys. Rev. Letters, 9: 500-2(Dec. 15, 1962).

The observed L to K electron capture ratio has been found to exceed by 5 to 25 percent the predicted ratio for all nine of the precisely measured allowed electron captures with Z between 18 and 36. Calculations presented remove this systematic disagreement between theory and experiment by including atomic states in the description of the radioactive system. The usual allowed theory of electron capture has been generalized to include atomic variables in the initial and final states. The exchange corrections are tabulated and found to be in good agreement with eight of the nine measured values. (H.D.R.)

9591 NEGATIVE MUON POLARIZATION IN PHOSPHORUS AND FLUORINE. D. P. Hutchison (Columbia Univ., New York), J. Menes, and G. Shapiro. Phys. Rev. Letters, 9: 516-18(Dec. 15, 1962).

The polarization of negative muons stopped in two substances of nuclear spin $\frac{1}{2}$ (P^{31} and F^{19}) was measured by precessing the negative muon spins in a high field (2kG) and looking for oscillations in the time distribution of decay electrons emitted in a fixed laboratory direction. A test run was made using a sulfur target, and the decay-electron time distribution is shown. The frequency spectra of electron time distributions is shown for sulfur, red phosphorus, and lithium fluoride. The phosphorus showed no polarization. The lithium fluoride spectra shows an expected precession peak at 10 Mc/sec and an unexpected peak at 20 Mc/sec. (H.D.R.)

9592 (n,p) REACTIONS IN MOLYBDENUM BY FISSION NEUTRONS. K. P. Gopinathan (Tate Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci., Sect. A, 56: 141-7(Sept. 1962). (In English)

Cross sections for the reactions $Mo^{92}(n,p)Nb^{92}$, $Mo^{95}(n,p)Nb^{95}$, and $Mo^{96}(n,p)Nb^{96}$ in natural Mo are calculated using the $Ni^{58}(n,p)Co^{58}$ reaction as the standard for the measurements. After chemical separation of the niobium isotopes from the target, a scintillation spectrometer was used to measure the photopeak of each isotope's characteristic gamma ray, thereby giving the isotope's activity to be compared with the standard. Results are listed and discussed. (D.C.W.)

9593 ANGULAR MOMENTUM EFFECT ON NEUTRON EVAPORATION. Tetsuo Kammuri (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), 28: 754-6(Oct. 1962). (In English)

An expression is given for the number of neutrons that can be emitted from a nucleus of spin I and energy E_x. Using this expression, the number of neutrons emitted by a compound nucleus formed in the collision of two nuclei is calculated. Calculations are shown, within the framework of several models, of the number of neutrons emitted in the collisions of 115-Mev C^{12} nuclei and 190-Mev Ne^{20} nuclei with Al, Ni, Cu, Ag, Ta, Au, and Pb nuclei, and these calculations are compared with experimental data. The effects of the emission of particles other than neutrons are noted. (T.F.H.)

9594 THEORETICAL STUDY OF SLIT SCATTERING. Edward J. Burge and David A. Smith (London Univ.). Rev. Sci. Instr., 33: 1371-7(Dec. 1962).

An expression is derived for the flux of multiply scattered charged particles emerging from a square-edge collimating slit for a parallel beam at normal incidence. Full allowance is made for the continuous energy loss in the slit material, and the results are compared with those from Courant's theory. The effective increase in aperture is calculated for 50-Mev protons on elements throughout the periodic table and the optimum materials for collimators are discussed. A computation of the origin on the collimator face of the slit-scattered flux from 50-Mev protons on copper shows that over 90% originate in the first 0.025 cm from the edge, when all energies are detected, and in less than 0.01 cm for energies above 37.5 Mev. The energy distribution is calculated as a function of the angular range accepted. The projected angle distribution, integrated over all energies, is found to have a maximum at about 1.5° for carbon, 4° for copper, and 7° for lead, with 50-Mev incident protons. The higher energy slit-scattered protons are shown to peak at smaller angles. Approximations in the theory are discussed and the results compared with those from Monte Carlo calculations by Becker and from the work of Överås. (auth)

9595 INVESTIGATIONS OF NUCLEAR LEVELS IN Ba^{136}. L. Simons (Univ. of Helsinki), E. Spring, P. Holmberg, H. Jungner, and E. Hageboe. Soc. Sci. Fennica, Commentationes Phy.-Math., 27: 5-22(1962). (In English)

By the measurement of gamma ray and coincidence spectra, the level scheme of Ba^{136} is verified. Angular correlation measurements of the cascades 1255 kev – 830 kev, 1065 kev – 830 kev, 337 kev – 1065 kev, 337 kev – (1065 kev) – 830 kev, 270 kev – 1065 kev, and 270 kev – (1065 kev) – 830 kev result in these spins for the levels: 1900 kev, 4^+; 2085 kev, 3; 2170 kev, 3 or 5; and 2240 kev, 4. The multipole mixing parameters are computed for the 1065 and 337 kev gamma rays. The possibility of the existence of a second excited level at 1660 kev is investigated by analysis of gamma and coincidence spectra. The 830 kev – 830 kev angular correlation is also measured. No definite answer is achieved. The intensity of the first 830 kev gamma ray is <1% of the intensity of the ground-state transition. (auth)

9596 EXCITATION STATE OF ODD NUCLEI WITH SMALL NON-AXIALITY. A. S. Davydov and R. A. Sardaryan. Vestn. Mosk. Univ., Ser. III, No. 4, 72-82 (July-Aug. 1962). (In Russian)

The spin sequence and energy ratio of excited odd nuclei with small non-axiality were calculated using a simple nuclear model without separating the one-dimensional and collective excitations. The results are correlated with experimental data. Spins and energies of nuclei with ground-state spins of $\frac{5}{2}$ and $\frac{7}{2}$ (U^{233}, Th^{231}, Cm^{245}, Bk^{240}, and Np^{237}) are tabulated. It was concluded that certain odd-nuclei excitation states ($\frac{3}{2}$ and $\frac{1}{2}$) that ordinarily are interpreted as one-dimensional excitations are in reality complex combinations of one-dimensional, rotational, and oscillatory excitations. (R.V.J.)

9597 CROSS SECTIONS FOR F^{19} PROTON ABSORPTION AT 6.6 Mev. S. S. Vasil'ev, E. A. Romanovskii, and G. F. Timushev. Vestn. Mosk. Univ., Ser. III, No. 4, 93 (July-Aug. 1962). (In Russian)

Proton absorption cross sections for F^{19} at 6.6 Mev were studied in order to verify an hypothesis on small and medium energy nucleon surface absorption. The total cross section of proton absorption at $E_p = 6.6$ Mev is $\sigma_t = \sigma_{pp'}[450\text{ mb}] + \sigma_{pp}[20\text{ mb}] + \sigma_{p\alpha}[10\text{ mb}] + \sigma_{pn}[55\text{ mb}]$; the order of error was not determined. Thus, for correlation with optical model calculations it was assumed that the σ_t for F^{19} at $E_p = 6.6$ Mev is $500 < \sigma_t < 550$ mb. (R.V.J.)

9598 THE HALF LIFE OF Rb^{87}. H. Leutz, H. Wenninger, and K. Ziegler (Universitat, Heidelberg). Z. Physik, 169: 409-16(1962). (In German)

The half life of Rb^{87} was measured by the following method: NaI(Tl) + RbI and CsI(Tl) + RbI scintillation crystals were grown containing 1.13 and 13 wt % RbI resp. The integral counting rates of these crystals were determined by extrapolation of the integral spectrum from 4 kev (NaI(Tl)) and 6 kev (CsI(Tl)) to zero energy. Then these crystals were pulverized, and the powder was counted in layers of saturation thickness in a methane flow counter. The counting rates of the flow counter were attached to the Rb contents of the layers by measuring mixtures of NaI(Tl) + RbI and CsI(Tl) + RbI powder of known compositions. By this procedure we determined the specific activity of natural rubidium at (744 ± 15) cps/g and the half life of Rb^{87} at $(5.80 \pm 0.12) \times 10^{10}$ years. This result agrees with other determinations obtained with scintillation crystals, but disagrees with results obtained with counter tubes and geological determinations. (auth)

9599 BRANCHING RATIOS AND MAXIMUM β^+ ENERGY IN THE DECAY OF Ag^{108}. Leberecht Frevert (Universitat, Göttingen, Ger.). Z. Physik, 169: 456-66(1962). (In German)

The branching ratios of Ag^{108} were remeasured with scintillation spectrometers. There is evidence for a weak 177 kev β^- branch going to the 1473 kev level of Cd^{108}, followed by a γ-γ cascade of (841 + 632) kev. Spin and parity 2+ of this level are supported by log ft = 4.7 of the β^- branch. The β^+ spectrum was measured for the first time yielding an end point energy of (880 ± 25) kev, in agreement with the value derived from the K/β^+ ratio. (auth)

9600 TOTAL CROSS SECTIONS FOR INTERACTION BETWEEN FAST NEUTRONS AND TIN ISOTOPES. Yu. V. Dukarevich, A. N. Dyumin, and D. M. Kaminker. Zh. Eksperim. i Teor. Fiz., 43: 1991-4(Dec. 1962). (In Russian)

The total cross sections for interaction between 14.2-Mev neutrons with $Sn^{116-120}$, Sn^{122}, and Sn^{124} were measured. The accuracy of the measurements is ±1%. It is found that the cross section does not vary in a monotonous fashion. An attempt is made to relate the mass number dependence of the cross section to the shell structure of the nucleus. (auth)

9601 INVESTIGATION OF COULOMB EXCITATION OF THE FIRST Mo^{92} LEVEL. O. F. Afonin, Yu. P. Gangrskii, I. Kh. Lemberg, V. A. Nabichvrishvili, and Yu. I. Udralov. Zh. Eksperim. i Teor. Fiz., 43: 1995-7(Dec. 1962). (In Russian)

The Mo^{92} nucleus has a closed neutron shell, and therefore the Coulomb excitation cross section is small and the background γ radiation due to nuclear reactions on light impurities makes it difficult to observe Coulomb excitation of Mo^{92}. The γ radiation background was diminished by recording coincidences between inelastically scattered bombarded particles and γ quanta emitted in the de-activation of the first excited state. The target enriched with Mo^{92} isotopes was irradiated with 40-Mev N^{14} ions accelerated in a cyclotron. The scattered ions were recorded with help of pn silicon detectors. The energy of the first Mo^{92} level was found to be 1.52 ± 0.03 Mev and the reduced transition probability 0.19 ± 0.08. (auth)

9602 PROBABILITY OF TRIPLE FISSION OF Pu^{239} INDUCED BY 0.05-0.7 ev NEUTRONS. A. A. Panov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 1998-9 (Dec. 1962). (In Russian)

The relative cross sections for double and triple fission of Pu^{239} induced by 0.05 to 0.7 ev neutrons are measured by a time of flight instrument with a resolution of 7 μsec/m. With an accuracy to 10% the probability of triple fission of Pu^{239} is found to be independent of the neutron energy. (auth)

9603 REFINEMENT OF THE INFORMATION OF THE $0^+ - 0^+$ TRANSITION IN Ce^{140}. V. A. Balalaev, B. S. Dzhelepov, A. I. Medvedev, A. Meshter, and I. F. Uchevatkin (All-Union Inst. of Metrology, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2019-20(Dec. 1962). (In Russian)

The Pr^{140} conversion electron spectrum is measured with a high-resolution and low-background β spectrometer. As a result more accurate data were obtained on some characteristics of the $0^+ - 0^+$ transition in Ce^{140} (energy, K/L ratio). (auth)

9604 ELASTIC SCATTERING OF PROTONS BY Si^{30} NUCLEI. A. K. Valter, A. I. Popov, and V. E. Storizhko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR and Khar'kov State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2038-41(Dec. 1962). (In Russian)

The differential cross section for elastic scattering of protons by Si^{30} nuclei is measured for proton energies between 1000 and 3650 kev and at angles of 90, 125, and 141° in the cms. In the energy range investigated 52 resonances were observed which are related to the excited states of the P^{31} nucleus. The most pronounced resonances are analyzed in the single-level approximation of dispersion theory. (auth)

9605 ON THE NUMBER OF NEUTRONS EMITTED IN SYMMETRIC FISSION OF U^{234} AND Pu^{240}. V. F. Apalin, Yu. N. Gritsyuk, I. E. Kutikov, V. I. Lebedev, and L. A. Mikaelyan. Zh. Eksperim. i Teor. Fiz., 43: 2053-5(Dec. 1962). (In Russian)

The number of neutrons ν emitted by U^{234} and Pu^{240} is measured for various fragment mass ratios. It is found that ν sharply rises in the neighborhood of symmetric fission. The dependence of ν on the mass ratio can be satisfactorily correlated to the total kinetic energy of the fragments. (auth)

9606 Zr^{97} DECAY SCHEME. A. A. Sorokin, M. Z. Shtal, and V. S. Shpinel (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2056-62(Dec. 1962). (In Russian)

The γ-ray spectrum and γ-γ coincidence spectra for the decay $Zr^{97} \rightarrow Nb^{97} \rightarrow Mo^{97}$ are investigated with the aid of a coincidence scintillation spectrometer and single-crystal γ spectrometer with a well-type NaI(Tl) crystal. It is found that besides the familiar 0.745-Mev isomeric state, excited states with energies 1.15, 1.35, 1.75, 1.84, and 2.1 Mev exist in the Nb^{97} nucleus. Possible characteristics of the levels are discussed. (auth)

9607 ON α-DECAY OF Ac^{225}. B. S. Dzhelepov, R. B. Ivanov, and L. N. Moskvin. Zh. Eksperim. i Teor. Fiz., 43: 2077-9(Dec. 1962). (In Russian)

The α spectrum of Ac^{225} is investigated by means of a magnetic α spectrometer. The energies and intensities of

previously known α transitions are in good agreement with the data presented. At least two new levels with energies at 388 and 544 kev are detected and tentatively assigned to the Fr^{221} nucleus. (auth)

9608 ON INTERACTION IN THE INITIAL AND FINAL STATES IN DIRECT NUCLEAR REACTIONS. V. A. Kaminskii and Yu. V. Orlov (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2146-9(Dec. 1962). (In Russian)

Interaction in the final state in direct nuclear reactions is rigorously taken into account within the framework of the dispersion method. An exact solution of the singular integral equation encountered in this problem is derived. Numerical calculations based on the exact solution reduce to the evaluation of a single quadrature. A comparison of the exact solution and first iteration is used for qualitatively explaining the success of the distorted wave method in describing direct processes. (auth)

9609 DISPERSION OF THE KINETIC ENERGY OF FISSION FRAGMENTS FROM HEAVY NUCLEI. B. M. Shiryaev. Zh. Eksperim. i Teor. Fiz., 43: 2150-2(Dec. 1962). (In Russian)

The effect of fragment rotation energy fluctuations on the dispersion of the total kinetic energy is considered. The estimations indicate that dispersion of the total kinetic energy of the fragments is due in an equal degree to fluctuations of rotational energy of the fragments and to fluctuations of the mean distance between the fragments during fission. (auth)

9610 SPIRALITY INVERSION IN NUCLEAR REACTIONS. N. P. Klepikov and Ya. A. Smorodinskii (Joint Inst. for Nuclear Research, Dubna, USSR and Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2173-8(Dec. 1962). (In Russian)

It is shown that for any spin a phase shift transformation exists which leaves all those observable quantities invariant which do not change when the spiralities of all particles participating in the reaction are changed. In the particular case of a spin $\frac{1}{2}$ the transformation involves the Minami ambiguity. Multiple scattering removes the invariance because of Thomas precession of the spin. (auth)

9611 ON THE SHAPE OF DIPOLE RESONANCE IN DEFORMED NUCLEI. S. F. Semenko (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 2188-93(Dec. 1962). (In Russian)

The single-particle excitation model in which residual interactions in the dipole state are taken into account is employed for analyzing the giant resonance in strongly deformed axially-symmetric nuclei. It is shown that such a model leads to conclusions (which are qualitatively in accordance with the experiments) concerning the relation between the center of gravity and characteristics of the energy spread of the longitudinal and transverse dipole maxima. (auth)

9612 NUCLEON-NUCLEON SCATTERING AMPLITUDES AND COMPLEXITY OF THE SPIN-ORBIT INTERACTION POTENTIAL BETWEEN NUCLEONS AND NUCLEI. L. S. Azhgirei, Yu. P. Kumekin, M. G. Meshcheryakov, S. B. Nurushev, and G. D. Stoletov (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2194-8(Dec. 1962). (In Russian)

Values of the amplitudes for 660-Mev nucleon-nucleon scattering in the forward direction averaged over the isotopic spin are derived on basis of the superposition model by employing the relations between the nucleon-nucleon and nucleon–nucleus scattering amplitudes. Comparison with a phase-shift analysis of the experimental data on nucleon-nucleon scattering shows that the spin-orbit potential of nucleon-nucleus interaction is complex in the 40 to 660 Mev energy range. (auth)

9613 ON THE MECHANISM OF INELASTIC SCATTERING OF γ-QUANTA ON NUCLEI. V. V. Balashov (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2199-2203 (Dec. 1962). (In Russian)

Deep-hole excitation states realized during E2 absorption of γ quanta are considered from the standpoint of the shell single-particle model. The main contribution to decay of such states is from radiative decay to excited nuclear levels. An analysis of the corresponding inelastic scattering of γ-quanta in the 20 Mev region shows that the features of shell structure of the nucleus remain up to very high excitation energies. Some experimental problems are mentioned. (auth)

9614 CLUSTER STRIPPING REACTION. V. E. Bunakov (Leningrad State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2224-9(Dec. 1962). (In Russian)

A theoretical formula for the stripping cross section of a nucleon cluster is deduced by taking into account the internal structure of the nuclei and clusters participating in the reaction. The theoretical angular distribution curve for the reaction $Li^6(Li^7,t)B^{10}$ is compared with the experimental data. (auth)

9615 COMPLEX SINGULARITIES OF THE AMPLITUDES FOR DIRECT NUCLEAR REACTIONS. L. D. Blokhintsev, E. I. Dolinskii, and V. S. Popov (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2290-8(Dec. 1962). (In Russian)

Rules for separating complex amplitude singularities lying on the physical sheet are indicated for nonrelativistic single-loop diagrams. A classification is presented for complex singularities of a nonrelativistic diagram with arbitrary masses. With triangular diagrams of direct nuclear reactions of the type $A + x \rightarrow B + y + z$ taken as an example it is shown that complex singularities with respect to the momentum transfer t_{xy} may be close to the physical region. A single analytic expression for the amplitude F_{31} of a triangular diagram is derived and the asymptotic behavior of F_{31} with variation of t_{xy} is investigated at large distances from the singularity. (auth)

9616 MEASUREMENTS ON THE DECAY OF ^{176}Ta WITH A COINCIDENCE SPECTROMETER. Hendrik Verheul. Thesis, Amsterdam, Vrije Universiteit, 1962. 77p.

Several nuclear models that describe rotational states of nuclei in the region $150 < A < 190$ are discussed since rotational motions can explain excited states. For purposes of studying the decay of tantalum-176 to the stable even-even nucleus hafnium-176 by electron-gamma coincidence measurements, theory and construction of solenoidal spectrometers with uniform magnetic fields are also discussed. Experimental data are given in graphs and tables, and the experimental decay scheme is compared with the previously discussed rotational models. 70 references. (D.C.W.)

9617 GAMMA SPECTROSCOPY AND ANGULAR CORRELATION MEASUREMENTS ON SOME EVEN MASS NUCLEI. Pieter Born. Thesis, Amsterdam, Vrije Universiteit, 1962. 83p.

Decay of arsenic-70, niobium-96, technetium-96, rhodium-102, and thallium-202 are investigated using gamma spectrometric methods that are described. Gamma spectra and angular correlation measurements are included as are proposed decay schemes and spin values of energy states. (77 references.) (D.C.W.)

9618 ENCYCLOPEDIA OF PHYSICS. S. Fluegge, ed. Volume XLI/2. Beta Decay. Berlin, Gottingen, Heidelberg, Springer-Verlag, 1962. 121p.

Experimental aspects of beta decay studies are reviewed, including neutrino hunting, spectra, ft measurements, polarization effects, coupling constants, electron capture, and double beta decay and internal bremsstrahlung. The limits of accuracy of the experimental data are discussed. (T.F.H.)

9619 (n,t)-REAKTIONEN AN MITTELSCHWEREN KERNEN. (Reactions (n,t) on Medium-Heavy Nuclei). Prom. Nr. 3209. Fritz Tanner. Thesis, Zurich, Technische Hochschule, 1962. 51p.

Measurements were made of the total effective cross section for triton emission induced by the capture of fission neutrons in medium-heavy nuclei. The method of measurement depended on the quantitative detection of the tritium produced by irradiation. The (n,t) cross sections for Al, Cr, Mn, Fe, Co, Ni, and Cu showed a satisfactory agreement with the results of the statistical nuclear theory. For silver, on the other hand, a compound nucleus representation was indicated when a reaction probability of about a factor of 38 too large was obtained for the appearance of direct processes. A method was developed in order to determine, in spectrally pure target material, extremely small lithium impurities, which could contribute to the tritium production by the reaction $Li^6(n,t)He^4$. (tr-auth)

9620 THE QUANTITATIVE ANALYSIS OF SETS OF MULTICOMPONENT TIME DEPENDENT SPECTRA FROM DECAY OF RADIONUCLIDES. W. L. Nicholson and J. E. Schlosser, and F. P. Brauer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). 31p. (HW-SA-2648)

To be published in NAS-NS-3107, Proceedings of the Symposium on Applications of Computers to Nuclear and Radiochemistry, held in Gatlinburg, Tenn., Oct. 18-19, 1962.

A weighted least squares method for estimating the effects of individual radionuclides in a multicomponent pulse-height spectrum is described. The method may also be applied to sets of spectra recorded over periods of time. The use of decay characteristics to supplement pulse-height characteristics increases the application and sensitivity of the method. (J.R.D.)

9621 APPLICATION OF THE CLUSTER MODEL OF THE NUCLEUS TO LIGHT NUCLEI. Faqir Chand Khanna. Thesis, Tallahassee, Florida State Univ., 1962. 55p.

The cluster model of the nucleus was used to investigate the low lying energy levels of Li^7 and Be^9. For Li^7 a neutron plus Li^6 configuration was assumed while in Be^9 a neutron plus Be^8 configuration was used. No positive parity state was found at 6.54 Mev in Li^7. The energy of the ground state of Be^9 was calculated and found to be in good agreement with the experimental value. Further calculation indicated that the level at 1.7 Mev is of character $\frac{1}{2}^-$. An attempt was made to estimate the effect of improving the internal and relative motion wave functions. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9622 FISSION STUDIES USING LOW ENERGY CHARGED PARTICLES. John Robert Meriwether. Thesis, Tallahassee, Florida State Univ., 1962. 96p.

The charged particle induced fission of Th^{232} and U^{238} was studied using a tandem Van de Graaff. The maximum particle energies was 12 Mev. Fission excitation functions for the reactions Th^{232} + p, U^{238} + p, Th^{232} + d, and U^{238} + d were determined in the region of the coulomb barrier. The excitation functions were fitted to a curve of barrier transmission coefficients and possible explanations are offered for the anomalously high barrier heights obtained. The peak to valley ratios of the kinetic energy spectrum of the fission fragments were measured as a function of proton energy using p-n junction counters. A plot of the ratios as a function of proton energy shows a general decrease in the ratio of asymmetric to symmetric fission as the energy is increased, with the exception of three upward breaks in each curve. In the bombardment of Th^{232} the breaks occurred at 7.70, 9 50, and 11.25 Mev and in the bombardment of U^{238} they occurred at 6.8, 8.5, and 10.60 Mev. The largest break occurred at the lowest energy and was attributed to the threshold for the (p,nf) reaction. The position of the break is in agreement with previously reported data. The two smaller breaks at higher energies are attributed to the (p,2n) and the (p,p'n) thresholds. This is based on the postulation that the onset of any new exit channel from the compound system will compete predominately with symmetric fission. Finally, measurements were made of the angular distributions of the fission fragments from the reactions; Th^{232} + p and U^{238} + p. A new type of scattering chamber is described in which the measurements were made. Using Griffen's method, values of the parameter K were determined in the energy region of 5 to 7 Mev above fission threshold. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9623 THE ELASTIC SCATTERING OF ALPHA PARTICLES BY O^{16} FROM 5.8 TO 10.0 Mev. William Everette Hunt. Thesis, Tallahassee, Florida State Univ., 1962. 118p.

Absolute differential cross sections for the elastic scattering by O^{16} of alpha particles from a tandem Van de Graaff accelerator were measured. Excitation curves were measured at ten angles with bombarding energies from 5.8 to 10.0 Mev. Detailed angular distributions were measured at energies of 6.97, 8.63, and 9.92 Mev. Sixteen resonances were observed at bombarding energies of 5.95, 6.58, 6.97, 7.20, 7.27, ~7.5, 7.63, (7.75), 7.87, 8.20, ~8.6, (8.95), 9.07, 9.42, 9.58, and 9.82 Mev. Positive spin and parity assignments were made for the levels corresponding to bombarding energies of 6.58, 6.97, ~7.5, 7.87, and 9.82 Mev. Tentative spin and parity assignments were proposed for the resonances at 7.2, 7.27, 7.63, 8.20, ~8.6, 9.07, and 9.42 Mev. Limits were established for the spin and parities of the resonances observed at 8.95 and 9.58 Mev. Reasonably good theoretical fits to the cross section were obtained for the angular distributions at 6.97 and 8.63 Mev. An interesting correlation of the data in terms of collective theory was made. It was possible to fit ten of the levels identified in the experiment into rotational bands. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9624 SCATTERING OF ALPHA PARTICLES FROM OXYGEN IN THE BOMBARDING ENERGY RANGE FROM 10 TO 19 Mev. Madhukar Kapilrai Mehta. Thesis, Tallahassee, Florida State Univ., 1962. 159p.

The scattering of alpha particles from O^{16} was studied by observation of the elastically scattered alpha particles and gamma rays from the excitation of the second, third, and fourth excited states of O^{16}, following the inelastic events. The bombarding energy ranged from 10 to 19 Mev. Junction counters were used to detect the alpha particles. Excitation curves were measured at eight angles and 36 levels in Ne^{20} were identified. Tentative spin and parity assignments for 17 levels were made from the behavior of the excitation curves at angles corresponding to the zeros of the Legendre Polynomials of first eight orders. Angular distributions of the elastic particles measured at seven energies show an oscillatory pattern. The data

were analyzed in terms of the Akhiezer-Pomeranchuk-Blair-McIntyre model, and the optical model. Good fits were obtained only when specific contributions from the resonances observed in the excitation curves were included in the APBM model. The optical model analysis resulted in good qualitative fits with real potentials of about 150 Mev and surface imaginary potential between 3 and 5 Mev. In general optical model fits were poor compared to the APBM results. Gamma rays were detected by NaI(Tl) crystals. The excitation curves showed considerable structure. Most of the levels observed in the elastic scattering were identified in the gamma ray experiment also. Angular distributions of the 6.14 Mev gamma rays from the deexcitation of the second excited state in O^{16}, were analyzed in terms of the compound nuclear states. This resulted in a spin and parity assignment of either 4^+ of 5^- to the state at 13.042 Mev and a probable assignment of 2^+ to the state at 17.290 Mev. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9625 INELASTIC SCATTERING OF ALPHA PARTICLES FROM CARBON. Gary Earl Mitchell. Thesis, Tallahassee, Florida State Univ., 1962. 161p.

The inelastic scattering of alpha particles from C^{12} was studied by observation of the alpha particles and of the gamma rays from the deexcitation of the first excited state. Gamma rays were detected with NaI(Tl) crystals. A yield curve from threshold to 17 Mev showed well isolated resonances in the region below 11 Mev. Detailed angular distributions in the lower energy region were analyzed in terms of compound nuclear states. At about 7.94 Mev there is apparently a 2^+ state in addition to the well known 1^- level. The following assignments were also made: 8.14 Mev (3^-), 8.96 Mev (4^+), 10.19 Mev (0^+ or 1^-). The assignments are in agreement with other investigations. Above 11 Mev the character of the gamma ray angular distributions changes very slowly with energy. The inelastic alpha particles were studied in the energy range 10 to 19 Mev; junction counters were used to detect the alpha particles. Although there is considerable structure in the excitation curves, the 15 angular distributions measured on the inelastic alpha particles show an oscillatory pattern and change relatively slowly with energy. Some data were obtained on the second inelastic group. The experimental evidence suggests that the reaction mechanism for the inelastic process is predominantly direct in the higher energy region. The data were analyzed with the strong coupling theory and computer codes. Qualitative success was achieved, although there was considerable difficulty in obtaining quantitatively good fits. One possible explanation for the difficulty is the explicit treatment of only two levels. Other levels may be strongly coupled. Since the coupling is rather extreme for the reaction, the particular features of the strong coupling theory are enhanced. Numerous calculations were performed to illustrate some of the general characteristics. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9626 HALF-LIVES OF AND ISOMERISM IN V^{46}, Mn^{50}, Co^{54}, AND Cu^{58}. David Chase Sutton. Thesis, Princeton, N. J., Princeton Univ., 1962. 194p.

Radiations associated with the decay of levels in V^{46}, Mn^{50}, Co^{54}, and Cu^{58} were studied by means of beta- and gamma-ray scintillation spectrometer techniques. The measured half lives of the high energy beta transitions were found to be $t_{\frac{1}{2}} = 0.424 \pm .002$ sec for $V^{46} \xrightarrow{\beta} Ti^{46}$; $t_{\frac{1}{2}} = 0.304 \pm .005$ sec for $Mn^{50} \xrightarrow{\beta} Cr^{50}$; and $t_{\frac{1}{2}} = 0.194 \pm .002$ sec for $Co^{54} \xrightarrow{\beta} Fe^{54}$. When combined with precise magnetic lens end point determinations, the results yield the respective ft values, 3093, 3180, and 3280 seconds. Implications regarding Fierz interference and isotopic spin impurities are discussed. No evidence of a super-allowed beta transition from Cu^{58} was found. Branching in the decay of 3-sec Cu^{58} was found. Branching ratios were derived from the results of investigations of gamma spectra, $\gamma\beta$, $\beta\gamma$, and $\gamma\gamma$ coincidence spectra. Isomerism was found to occur in Mn^{50} and Co^{54}. For these isotopes beta- and gamma-activities were assigned to the decays of levels which are independent of the beta decay of the O^+ states. In the case of Co^{54} a 1.5-minute positron group of about 4.3 Mev end point is shown to be in coincidence with a triple cascade involving 0.41, 1.13, and 1.41 Mev gamma rays, suggesting a spin of 6 or 7 for 1.5^m-Co^{54}. A complex cascade, involving 0.785, 1.09, and 1.42 Mev gamma rays and less intense 0.66 and 1.28 Mev gamma rays, follows the beta decay of 1.7-minute Mn^{50}, involving positron group(s) of about 3.2 Mev maximum energy. In V^{46} no evidence was found of an isomeric state where beta decays independently of the O^+ state. The results are discussed in the light of various nuclear models. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9627 Cf^{252}, A PRIMARY STANDARD FOR NEUTRONS. P. R. Fields and H. Diamond (Argonne National Lab., Ill.). IAEA Preprint SM-36/68. 20p. (TID-17527).

To be published in IAEA Proceedings of the Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962.

Californium-252 is examined as a primary standard for neutrons. Similarity of the energy spectrum of neutrons from spontaneous fission of Cf^{252} to spectra from fission of U^{233}, U^{235}, and Pu^{239} as well as ease of determining the absolute neutron emission rate makes Cf^{252} a good standard for research on virgin fission neutron spectra in reactors. Cf^{252} sources are easily prepared and require little shielding. Correction for effects of Cf^{252} decay in sources and particle output of single fissions is discussed. (D.C.W.)

Particle Accelerators

9628 (BNL-747) HIGH ENERGY ACCELERATORS. Ernest D. Courant (Brookhaven National Lab., Upton, N. Y.). Apr. 12, 1961. Contract [AT(30-2)-Gen-16]. 28p. (BNL-T-273)

Brookhaven Lecture Series No. 6.

Recapitulation of concepts in accelerator design and discoveries made using certain types of accelerators are qualitatively provided as part of a lecture series. (D.C.W.)

9629 (BNL-5847) D-C POWER FOR NUCLEAR PARTICLE RESEARCH. John M. Ruddy (Brookhaven National Lab., Upton, N. Y.). Dec. 6, 1961. Contract [AT-30-2-GEN-16]. 10p. (BR-225R)

Increased power needed for advanced work with Brookhaven National Laboratory's Cosmotron results in enlargement of the lab's d-c power facilities. A report on revisions made in the original power layout is given and indicates that silicon rectifiers are more suitable than the motor-generator sets of earlier additions. (D.C.W.)

9630 (BNL-6420) SYNCHROTRON OSCILLATIONS. E. H. Hochman and M. Q. Barton (Brookhaven National Lab., Upton, N. Y.). May 1, 1962. Contract [AT(30-2)-Gen-16]. 16p.

Numerical calculations were done which permit the deduction of many properties of the synchrotron oscillation problem. A review of the formulation framework to which the results are to be fitted is given. These are worked out for an arbitrary circular accelerator. The algebra would have to be modified slightly to include straight sections, but the numerical results are still useful. (J.R.D.)

9631 (BNL-6424) SERVO SYSTEM FOR MAGNETIC CONTROLLED CONSTANT INTENSITY FLAT TOP BEAM SPILL-OUT. J. G. Cottingham (Brookhaven National Lab., Upton, N. Y.). Nov. 21, 1961. Contract [AT(30-2)-Gen-16]. 11p.

It is noted that a uniform flat-top beam spill-out cannot be obtained in the Cosmotron by manual control. A servo system is proposed which will control this spill-out by sensing the external beam intensity, and correcting the magnet voltage to keep this intensity constant. This servo must operate through the transfer function of the main ignitron system and the flat-top filter. An analysis of these special transfer functions is presented. (J.R.D.)

9632 (BNL-6425) NON-LINEAR BUNCH MOTION AT TRANSITION. Harald Hahn (Brookhaven National Lab., Upton, N. Y.). Dec. 4, 1961. Contract [AT(30-2)-Gen-16]. 30p.

Inclusion of nonlinearities in the equations for phase oscillations derived for studying proton bunch behavior in the Brookhaven AGS leads to a new stable equilibrium point for the bunch not coincident with the usual stable phase angle. Equations and equilibrium point stability are examined. (D.C.W.)

9633 (BNL-6426) TARGET EFFICIENCY MEASUREMENTS AT THE AGS. A. W. Maschke (Brookhaven National Lab., Upton, N. Y.) June 6, 1962. Contract [AT(30-2)-Gen-16]. 6p.

Two methods for measuring target efficiencies are briefly discussed. The second method puts an upper bound on the efficiency and permits observation of instantaneous efficiency, thereby aiding location of losses. Measurements agree well with conventional radiochemical values. (D.C.W.)

9634 (BNL-6427) THE BALL TUNER CHANGE TABLES. J. L. Walters (Brookhaven National Lab., Upton, N. Y.). May 3, 1962. Contract [AT(30-2)-Gen-16]. 8p.

Technique used in deriving values of the linac ball tuner settings to produce various fields is discussed briefly, and tables showing ball tuner change numbers and values used in making up the ball tuner change numbers are given. (D.C.W.)

9635 (BNL-6428) DESIGN OF REFLECTOMETERS FOR COAXIAL LINES USED AT AGS LINAC. J. L. Walters (Brookhaven National Lab., Upton, N. Y.). May 9, 1962. Contract [AT(30-2)-Gen-16]. 10p.

Mathematical treatment is given the design for a reflectometer to be used with the Brookhaven alternating-gradient synchrotron. Diagrams of various reflectometers are displayed. (D.C.W.)

9636 (BNL-6429) SOME PROPERTIES OF STUB TUNERS WHICH CAN BE DISPLAYED ON SMITH CHARTS. J. L. Walters (Brookhaven National Lab., Upton, N. Y.) May 9, 1962. Contract [AT(30-2)-Gen-16]. 11p.

Use of the Smith chart in studying stub tuners is demonstrated. Several properties of the tuners are shown, and charts for various wave length spacings, tuning trajectories, and admittances are included. (D.C.W.)

9637 (BNL-6430) TIME DEPENDENCE OF SPACE CHARGE BEAM LOSSES IN THE COSMOTRON. M. Q. Barton and E. J. Sacharidis (Brookhaven National Lab., Upton, N. Y.). Jan. 4, 1962. Contract [AT(30-2)-Gen-16]. 12p.

An investigation was made of Cosmotron intensity versus time through the entire time interval from the beginning of injection to the completion of r-f capture. The induction electrode signal was used for the instantaneous measurement of beam intensity. Oscilloscope displays of the signal were photographed and traced. Base lines were filled in on the tracings and the area of the pulses measured with a polar planimeter. It was found that the relation losses of beam intensity increase with injection intensity (total injected charge), and that most of the losses take place in the time interval between the end of injection and the completion of the first synchrotron oscillation. (M.C.G.)

9638 (BNL-6431) COMPUTATIONS FOR AGS EXPERIMENTAL BEAMS. DESCRIPTION OF COMPUTER PROGRAM. Winslow F. Baker (Brookhaven National Lab., Upton, N. Y.). Dec. 15, 1961. Contract [AT(30-2)-Gen-16]. 22p.

Programming a computer that optimizes the beam in the Brookhaven AGS is discussed. Layout, method, and routines are given particular attention, and representative data cards are shown. (D.C.W.)

9639 (BNL-6432) ACCELERATION OF POLARIZED PROTONS TO RELATIVISTIC ENERGIES. E. D. Courant (Yale Univ., New Haven and Brookhaven National Lab., Upton, N. Y.). Jan. 22, 1962. Contract [AT(30-2)-Gen-16]. 7p.

Maintenance of polarization of polarized protons in a linear accelerator is known to be feasible. Circular accelerators present a different problem, and the investigation of the interaction of orbit dynamics and particle polarization in general is undertaken. The equation of motion of the spin vector of a charged particle in a magnetic field as formulated by Bargman, Michel, and Telegdi is utilized in the study of depolarization for several accelerators. High values of depolarization are obtained, and means for avoiding such depolarization are suggested. (D.C.W.)

9640 (BNL-6433) EFFICIENCY OF MULTIPLE TRAVERSAL TARGETS. E. D. Courant (Brookhaven National Lab., Upton, N. Y.). Feb. 5, 1962. Contract [AT(30-2)-Gen-16]. 12p.

The efficiency of multiple traversal targets is defined as the probability that a proton dies by making a nuclear collision in the target rather than by hitting the limit of the synchrotron aperture. The efficiencies of Be, Al, Cu, and Pb targets are shown for 15 and 30-Bev protons in the Brookhaven AGS. Beryllium was found to be the most efficient. (M.C.G.)

9641 (BNL-6434) INTERNAL BUNCHING IN THE ALTERNATING GRADIENT SYNCHROTRON. D. S. Robertson (Brookhaven National Lab., Upton, N. Y.). Jan. 16, 1961. Contract [AT(30-2)-Gen-16]. 35p.

Four methods of rebunching protons within Brookhaven's AGS are discussed. The first method involving switching off the old r-f and switching on the new r-f simultaneously with the new r-f increasing adiabatically seems impractical. Two other methods utilize gradual removal of the old r-f voltage and introduction of the new r-f voltage, or the reverse. Removal of the old r-f voltage followed by introduction of the new seems to give the best results. Several phase diagrams are included. (D.C.W.)

9642 (BNL-6435) MAGNETIC MEASUREMENTS OF AGS EXPERIMENTAL MAGNETS. Gordon T. Danby (Brookhaven National Lab., Upton, N. Y.). Dec. 26, 1961. Contract [AT(30-2)-Gen-16]. 24p

The approach taken in measurements on the AGS experimental magnets is discussed, and results of various measurements are examined. Application of information to calibration of beam lenses is also mentioned. Graphs of several magnet properties are included. (D.C.W.)

9643 (BNL-6436) POSSIBLE USE OF A BETATRON CORE ON THE COSMOTRON. L. W. Smith (Brookhaven National Lab., Upton, N. Y.). Jan. 18, 1962. Contract [AT(30-2)-Gen-16]. 4p.

Most existing electron synchrotrons use betatron start for initial acceleration of the particles. The subsequent synchrotron acceleration is then performed with a nearly constant radio-frequency. Investigation of the effect of turn-on rate and initial energy spread is made mathematically. Several advantages are seen for such a technique. (D.C.W.)

9644 (CERN-62-24) AIMANTS SPECIAUX POUR L'EXTRACTION DES PARTICULES SECONDAIRES DU SYNCHROTRON A PROTONS. (Special Magnets for the Extraction of Secondary Particles from the Proton Synchrotron). M. Barbier, L. Chareyre, G. Petrucci, M. Sceptycka, and F. Solinas (European Organization for Nuclear Research, Geneva). Aug. 9, 1962. 14p.

Two special magnets were constructed at CERN for a secondary particle beam having a maximum of 3 Bev/c and an emission angle of 6°. These magnets are excited by direct current and focus the particles at the same time that they leave. In the particular case of the A_2 beam where they have been employed they give a target image at approximately a meter distance from the edge of the second magnet output. The deflection angle of the first magnet is 9° and that of the second is 15°. The acceptance obtained is 3×10^{-4} sterad. The chromatic dispersion in the image plane is approximately 19 mm/% dp/p. (tr-auth)

9645 (CERN-62-26) LOW ENERGY SEPARATED BEAM AT THE C.E.R.N. P.S.B. Aubert, H. Courant, H. Filthuth, A. Segar, and W. Willis (European Organization for Nuclear Research, Geneva). Aug. 22, 1962. 27p.

The development and performance of an electrostatically separated beam designed to provide particles for experiments, e.g., K^+ and K^- at 800 Mev, K^+ stopping in heavy liquid chambers, and K^- stopping in liquid H_2 or emulsions, are described. (J.R.D.)

9646 (ORNL-3289) NUCLEON-MESON CASCADE CALCULATIONS: TRANSVERSE SHIELDING FOR A 45-Gev ELECTRON ACCELERATOR. PART I. R. G. Alsmiller, Jr., F. S. Alsmiller, and J. E. Murphy (Oak Ridge National Lab., Tenn.). Jan. 11, 1963. Contract W-7405-eng-26. 110p.

Using a straight-ahead approximation, a set of coupled integrodifferential transport equations which describe a nucleon-meson cascade is given. In order to carry out calculations the necessary physical information concerning high-energy interactions has been extracted from cosmic-ray data by introducing many ad hoc assumptions. Calculations have been carried out for several are of interest in the design of the shield for the proposed 45-Bev Stanford accelerator. Because of the very crude nature of the input data the results must be considered very approximate. The equations and the IBM-7090 code which solves them numerically are not restricted to the Stanford problem, but may be used for other high-energy shielding calculations. (auth)

9647 (TID-17021) LINEAR ELECTRON ACCELERATOR STUDIES. Status Report, October 1–December 31, 1958. (Stanford Univ., Calif. Microwave Lab.). Feb. 1959. Contract AT(04-3)-21. 47p. (ML-581)

Reports on investigations of r-f structures suitable for accelerating electrons, upper passbands of disk-loaded structures, and non-intercepting electron beam detectors are supplemented by reports on development of evacuated coaxial high-power loads, all metal vacuum seals, and phase comparison devices. Studies of accelerator klystrons, and r-f injection systems are also reported. The Mark IV accelerator program, a method of phasing long linear accelerators, and accelerator fabrication techniques are also discussed. (D.C.W.)

9648 (TID-17415) A DESIGN FOR AN ACCELERATING SECTION TO EXTRACT AND CONTROL A LARGE CURRENT OF PROTONS. H. Fechter and A. Saulys (Argonne National Lab., Ill.). Sept. 4, 1958. Contract [W-31-109-eng-38]. 23p. (ANLAD-53)

Design of an ion beam extracting and accelerating structure to be used with the Argonne Synchrotron is discussed. Theory and results of iteration calculations are presented, as are equipotential and axial field plots. Diagrams of the apparatus are also included. (D.C.W.)

9649 (TID-17578) ANNUAL PROGRESS REPORT FOR PERIOD DECEMBER 1961–NOVEMBER 1962 [ON LINEAR ACCELERATOR]. (Minnesota. Univ., Minneapolis. Linear Accelerator Lab.). Nov. 1962. Contract AT(11-1)-50. 136p.

The performance of the accelerator is discussed, along with improvements, additional equipment, and techniques that were developed to increase its usefulness. Operation, injector improvements, experimental program, experimental instrumentation, and the theoretical program are described. (M.C.G.)

9650 (UCRL-6575) AUTOMATIC FREQUENCY CONTROL OF ELECTRON LINEAR ACCELERATORS THROUGH THE USE OF DIGITAL TECHNIQUES. Harlin L. Bunn (California. Univ., Livermore. Lawrence Radiation Lab.). Oct. 17, 1961. Contract W-7405-eng-48. 43p.

A digital system for controlling the mechanical tuning of a microwave cavity oscillator has been designed for use with accelerators. The microwave oscillator is used for driving the klystrons which provide the RF energy to accelerate the electrons to the desired energy. A logical system samples the electron beam pulse, which is at maximum amplitude when the microwave frequency is optimized. If the frequency drifts up or down, the system drives a dc stepping motor to which is geared the oscillator cavity and retunes the oscillator to the correct frequency. An additional feature built into the system provides the correct startup operation (automatic frequency search) when the ac power is applied to the oscillator. To conserve development time and cost, the system design is based mainly on use of standard, commercially available, solid-state logic circuit modules. Modules designed by Lawrence Radiation Laboratory (LRL) are used where simplification is to be gained. The logic circuitry of the system based on these modules is described in detail. (auth)

9651 (UCRL-10075) COMPUTATIONAL PROCEDURES IN THE ADJUSTMENT OF A CYCLOTRON MAGNETIC FIELD BY TRIM COILS. Jonathan D. Young, Ardith S. Kenney, and Alper A. Garren (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 2, 1962. Contract W-7405-eng-48. 9p.

An outline is presented of the system of computational codes used to obtain values for the trim-coil currents to effect an optimal adjustment of the magnetic field in the 88″ cyclotron at Berkeley according to the method described by one of the authors. The machine computation is traced through steps of analysis of measured field data, determination of restraints for a linear model of the problem, construction of the linear-program matrix, solution for values of trim-coil currents, iteration to improve on this solution, and prediction of orbit properties in corrected field. (auth)

9652 THE EFFECTS OF BEAM LOADING ON THE CHARACTERISTICS OF A LINEAR ELECTRON ACCELERATOR. E. L. Burshtein and G. V. Voskresenskii. At. Energ. (USSR), 13: 446-53(Nov. 1962). (In Russian)

In the calculation of linear electronic accelerators it is usually assumed that only external accelerating and focusing forces act upon the particles; however, when the beam current is increased, the effect of the electromagnetic field created by the particles themselves becomes noticeable. Making use of previous calculations of the authors (Nauchnye trudy RAIANa SSSR, III, No. 3, 1961) on fields generated by particles and particle clusters moving in moderating media, accelerator calculations carried out, taking the beam loading, in particular under stationary operating conditions, into account. The longitudinal field acting on the particles is composed of 3 components: the accelerating field due to the generator, the moderating field of the Cherenkov radiation, and the Coulomb repulsion field; the latter is negligibly small. An expression was derived for determining the total radiation field and operation of the accelerator was examined under stationary, transient and shortlived pulsed conditions. (TTT)

9653 THE PADUA UNIVERSITY 5.5 Mev ACCELERATOR LABORATORIES. A. Rostagni. Comit. Nazl. Energia Nucl., Notiziario, 8: No. 12, 117-26(Dec. 1962). (In Italian)

The Laboratories of the Padua University's 5.5 Mev accelerator, in operation since the end of 1961, are described. (auth)

9654 MEASURING THE MAGNETIC PARAMETERS OF THE BETATRON OF THE INSTITUTE OF NUCLEAR PHYSICS OF THE ROMANIAN ACADEMY–DETERMINATION OF THE POSITION OF THE EQUILIBRIUM ORBIT. Constantin Iliescu, Stefan Haltrich, and Iulian Leibovici. Electrotehnica, No. 1, 3-10(1962).

The position of the equilibrium orbit in a 30-Mev betatron was determined. Magnetic measurings on the betatron having an energy gain per turn of 30 ev, were carried out under a-c supply conditions, under real operating conditions, but with the doughnut removed, to permit the insertion of the measuring instruments into the air gap. The measurements were accomplished at half voltage supply of the electromagnet, at 3 kv, and at full voltage supply, at 6 kv. The equation and methods used for determining the radius of the equilibrium orbit are given. Determinations were carried out for a great number of values of the radius of the equilibrium orbit. The values were modified either by varying the air gap of the electromagnet, or by using a correction current supplied by a special coil. Owing to the effects of the nonlinearity of the magnetic circuit, the position of the equilibrium orbit at high inductions was displaced as against conditions of law and medium inductions. This phenomenon therefore required a correction of the equilibrium orbit displacement at high inductions. The corrections required a measuring of the variation of the radius of the equilibrium orbit. Several magnetic methods and a radiometric method were tested in the determination of the radius of the equilibrium orbit of the Romanian betatron. All magnetic determinations were carried out with the same measuring instrument. The induction comparison method using an annular guide-field coil proved to be the most efficient method, being used also in the determination of the variation in time of the position of the equilibrium orbit. (P.C.H.)

9655 FIELD INHOMOGENEITIES OF A BETATRON MAGNET. Takio Tomimasu (Electrotechnical Lab., Tokyo). Japan. J. Appl. Phys., 1: 343-9(Dec. 1962). (In English)

Field inhomogeneities of a betatron with H-type magnet are investigated with peaking-strip and search-coil methods. A formula estimating the time lag between the field applied externally and the corresponding induction is given theoretically as a function of various parameters of the magnet and the materials in the magnet. The field inhomogeneities are discussed on the basis of this formula and explained as resulting from inhomogeneities of angles φ between magnetic paths and laminations in the magnet. The angle is attended with a large time lag, and an effective thickness of the lamination in the pole piece may be considerably large, at least at low field. The upper limit of the angle φ may be estimated to be of the order of $d_s(r)/L_s$, where $d_s(r)$ is the thickness of the sector at a radius r, and L_s is the length along the magnetic path of the sector. (auth)

9656 A MEASUREMENT OF THE BEAM CURRENT OF AN ELECTRON ACCELERATOR. Teiji Umemura and Hisao Kami (Industrial Research Inst., Osaka). Japan. J. Appl. Phys., 1: 363-4(Dec. 1962). (In English)

An apparatus is described that can continuously monitor the electron beam current falling on a moving metal sample conveyor. The apparatus is insensitive to the electron energy. (T.F.H.)

9657 VOLTAGE STABILIZER FOR THE 1 Mev COCKCROFT-WALTON GENERATOR. Tahir Husain (Government Coll., Lahore, West Pakistan). J. Nat. Sci. Math., 2: 57-61(Oct. 1962).

In order to control long period fluctuation in the level of the high voltage of the Cockcroft-Walton Generator, a circuit has been constructed which maintains the beam energy within ±150 volts. (auth)

9658 ELECTRON GUN IN A 4-Mev PARTICLE ACCELERATOR (ELECTROSTATIC GENERATOR). Endre Pásztor. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 9: 77-85(1961).

Requirements imposed on a source of elementary particles in an electrostatic generator are discussed: rigidity of mechanical design, mounting facilities, long operation time, low power consumption, good efficiency, correspondence to the optical system of the accelerator, and relatively low tensions on the electrodes. To meet the requirements, an investigation was made with the aid of an electrolytic tank. As a result, the optimum conditions and design of the gun were determined. In particular, the expedience of employing two electron lenses is explained. Curves are given for the dependence of the electron current on the tensions at the controlling and accelerating electrodes, and also the dependence of the filament current on the filament voltage. (Referativnny zhurnal, Fizika, No. 6, 1962)

9659 A MILLION Mev ACCELERATOR. Nucl. Power, 7: 61-2(Dec. 1962).

Recent Soviet elaboration of a theory permitting prediction of certain properties of particles under the most interesting strong interaction is leading to the development of a million Mev accelerator. Precision requirements make use of cybernetic principles likely in controlling such an accelerator. (D.C.W.)

9660 MODEL OF THE HIGH FREQUENCY SYSTEM OF THE RING-SHAPED PROTON SYNCHROTRON. A. A. Glazov, E. Schwabe, and V. A. Kochkin. Nukleonika, 7: 455-63(1962). (In Russian)

A calculation and experimental investigation are carried out on a model of the high-frequency system of the ring-shaped proton synchrotron having spiral variation of the magnetic field intensity. It is shown that in operation on the

ninth frequency stage of proton rotation a possibility arises of constructing a high frequency system with accelerating elements in the form of drift tubes. This system has a frequency variator that ensures a necessary range of frequency overlapping of 8 to 25 Mc and an accelerating voltage of 2.0 kv/rev ± 20% with small power of the high-frequency generator. This low-power operation is achieved as a result of resonance properties of the feeder lines connecting the drift tubes with the high-frequency generator. (auth)

9661 LINAC BEAM POSITION MONITOR. R. Bergere, A. Veyssiere, and P. Daujat (Centre d'Etudes Nucleaires, Saclay, France). Rev. Sci. Instr., 33: 1441-9(Dec. 1962).

After a brief review of the structure of electron pulses from a linear accelerator and the properties of the electrical and magnetic fields set up by a beam of relativistic electrons, a beam position monitor designed and used with the linear accelerator at CEN Saclay is described. A description of operation then follows with indications of possible applications. (auth)

9662 OPERATION OF A 15-Mev BETATRON. O. P. Nikotin, B. T. Plachenov, and V. P. Sergeev. Tr. Leningr. Tekhnol. Inst. im. Lensoveta, No. 55, 28-31(1961).

The 6-yr operation of the LTI 15-Mev betatron has shown that the battery of capacitors reliably functions in the circuit of a magnet with a reactive power of 300 kva and a voltage of 3 kv. The magnetic field, adjusted by the selection of compensating turns in the stands of the magnet, did not change appreciably in the process of operation. The system of stabilization of electron energy, which was constructed in view of unstable voltage in the network and yields a good energy resolution (± 10 kv), is presented. The system is simple, stable in operation, consists of standard components, and needs only two supply sources. At present, a system is being tested to make it possible to insert specimens into the chamber for irradiation without destroying the vacuum. In this system, targets are fastened on a hollow cylindrical Al chamber which is introduced into the betatron chamber by means of a bellows-sealed accessory. (OTS)

9663 SPACE CHARGE INTERACTIONS WITH H-F FIELD IN CYLINDRICAL ACCELERATORS. V. K. Grishin. Vestn. Mosk. Univ., Ser. III, No. 4, 40-4(July-Aug. 1962). (In Russian)

Space charge interactions with high-frequency fields in cyclic accelerators that strongly influence the autophasing acceleration processes were studied using kinetic equations. Accelerator operation with increased current capture is described. (tr-auth)

9664 RESEARCH ON THE DEVELOPMENT OF A HIGH FREQUENCY ACCELERATOR FOR PROTONS. Horst Geuge (Technische Hochschule, Munich). Z. Angew. Phys., 14: 517-29(Sept. 1962). (In German)

For a high-frequency proton acceleration (20 MHz), a coolable concentric λ/4 lead and the necessary vacuum installation were designed and built. Then a self-excited 50-kw output transmitter was coupled and adapted, and the frequency behavior of the system was investigated. By consideration of given phase relations, an acceleration gas was constructed, and the proton energies obtainable were detected and measured using the reactions $Li^7(p,\gamma)Be^8$ and $F^{19}(p,\gamma,\alpha')O^{16}$. Continuous operation is limited to resonance voltages under 200 kv. (tr-auth)

9665 ANALYSIS OF THE PERFORMANCE OF MERCURY-ARC RECTIFIERS FOR A PROTON SYNCHROTRON. G. O. Calabrese (Pennsylvania Military Coll., Chester). Preprint Paper No. CP 63-195. New York, The Institute of Electrical and Electronics Engineers, 1963. 27p. $1.00.

Paper from Winter General Meeting, New York, Jan. 27-Feb. 1, 1963.

Expressions are developed which refer to a simple polyphase mercury-arc rectifier system with phase angle control assuming that during commutation the output current varies linearly with time. Exact and approximate expressions are derived for calculating the currents during commutation, and the angle of commutation with and without phase angle control, including the effect of arc-drops and of the time variation of the magnet current. The conclusions are extended to parallel or series or parallel series combinations of simple rectifier systems. (R.J.S.)

9666 HIGH-VOLTAGE GENERATOR WITH SOLID INSULATION. Harald A. Enge (to High Voltage Engineering Corp.). U. S. Patent 3,071, 702. Jan. 1, 1963. Filed Dec. 3, 1958.

An electrostatic belt-type generator is designed whose length only increases with increasing voltage. The generator comprises an elongated insulating column enclosing the belt, and a series of alternating thin layers of insulating and conductive material surrounding the column. The conductive layers are connected to equipotential points on the column, and the successive layers increase in dimension from the innermost to the outermost layer. The high-voltage terminal is located in the middle of the column. (D.L.C.)

9667 BEAM SPLITTER. William B. Jones and P. F. McWalters (to U. S. Atomic Energy Commission). U. S. Patent 3,072,786. Jan. 8, 1963.

This patent relates to a device utilizing electrostatic fields for splitting the high energy ion beam of a particle accelerator into two separate beams. Many accelerator targets cannot utilize the full available beam current, and thus two such targets can be bombarded simultaneously if the beam is divided. The apparatus comprises a long center plate disposed along the center of the beam between a pair of long deflection plates disposed one on each side of the beam. Intense, oppositely directed electric fields are established between each of the deflection plates and the center plate causing the beam to split longitudinally. Each beam portion can then be individually directed to separate targets. (AEC)

Plasma Physics and Thermonuclear Processes

9668 (62-RL-3113E) NONEQUILIBRIUM IONIZATION IN DISCHARGES AT ELEVATED PRESSURES. H. Hurwitz, Jr. (General Electric Co. Research Lab., Schenectady, N. Y.). Sept. 1962. 25p.

The present status of theory and experiment on the subject of nonequilibrium ionization in discharges in which the electron mean free path is small compared to the dimensions of the system is discussed. (auth)

9669 (62-RL-3122E) NONEQUILIBRIUM IONIZATION IN A HIGH-PRESSURE CESIUM-HELIUM TRANSIENT DISCHARGE. D. J. BenDaniel and C. M. Bishop (General Electric Co. Research Lab., Schenectady, N. Y.). Sept. 1962. 14p.

Voltage gradient vs current density measurements of a discharge in helium seeded with cesium are given over the range of current densities of 0.1 to 20 amps/cm^2, cesium densities of 4×10^{13} to 4.5×10^{14}/cm^3, and at helium

densities of 2.5 and 5.0 × 10^{18}/cm^3. Readings were taken at a time (50 μsecs) sufficiently long to allow electron temperature and ionization to be established but short in comparison with the heating time of the gas. Results compare quite favorably with the theory of nonequilibrium ionization, also discussed. A positive resistance characteristic is observed in most of the regime. (auth)

9670 (62-RL-3169E) LARGE AMPLITUDE MAGNETIC COMPRESSION OF A COLLISION-FREE PLASMA. III. PLASMA MAGNETIC SHOCK WAVES WITH INITIAL TEMPERATURE. R. W. Kilb (General Electric Co. Research Lab., Schenectady, N. Y.). Nov. 1962. 25p.

Earlier work on collisionless magnetohydrodynamic shock waves traveling perpendicular to the magnetic field lines was extended. Its purpose was to extend the previous model and numerical calculations to allow for an initial temperature in the unshocked plasma. It was assumed that the initial magnetic pressure is of the same order, or greater than the initial particle pressure. A Fortran code was written for the shock model, and a detailed description is given of the input and output of the program. The results of the model show that in a collisionless shock the electrons are heated adiabatically as the shock front passes, while the ions are heated nonadiabatically as well as adiabatically. The nonadiabatic heating occurs above Alfvén-Mach number 2. The model is restricted to Alfvén-Mach numbers of roughly 20 or less. (auth)

9671 (AFCRL-62-340) PART I. THEORY OF FLUCTUATIONS IN A PLASMA. PART II. WAVE PROPERTIES OF A PLASMA WITH A DOUBLY-HUMPED VELOCITY DISTRIBUTION. Scientific Report No. 1. S. Ichimaru (Illinois. Univ., Urbana. Electrical Engineering Research Lab.). May 15, 1962. Contracts AF19(604)-7411 and AF19(604)-7473. 101p. (AD-277495)

A theory of electron density fluctuations in a two-component plasma of electrons and positive ions is developed within the random phase approximation. An investigation of the properties of the growing waves in a uniform plasma with a doubly humped velocity distribution is carried out by studying the character of the boundary curves between growing waves and damped waves. (auth)

9672 (AFOSR-1100) A SPECTROSCOPIC TECHNIQUE FOR THE MEASUREMENT OF TEMPERATURE IN TRANSPARENT PLASMAS. Carl F. Knopp, Chad F. Gottschlich, and Ali Bulent Cambel (Northwestern Univ., Evanston, Ill. Gas Dynamics Lab.). July 1961. Contract AF49(638)-879. 106p. (AD-277352)

A spectroscopic technique developed by Fowler and Milne was employed to evaluate the temperature in a plasma produced by an electric arc. Design of the experimental apparatus used in this study is discussed and representative results obtained with the apparatus are given. In the course of the investigation, the theoretical particle densities as well as the partition function of an argon plasma were calculated. (auth)

9673 (ARL-62-417) STUDIES OF THE DYNAMIC PROPERTIES OF LANGMUIR PROBES. Hendrik J. Oskam, Richard W. Carlson, and Takayoshi Okuda (Minnesota. Univ., Minneapolis). June 11, 1962. Contract AF33(616)-7034. 170p.

The dynamic behavior of a Langmuir probe immersed in a gaseous plasma is studied by using various measuring techniques. The delay in the current collection is investigated as a function of probe potential and plasma parameters and a qualitative theory based upon the motion of ions is presented. The capacitance of the probe sheath is calculated and compared with the measured values. In order to eliminate the influence of the stray probe capacitance on the measurements a shielded Langmuir probe was developed. (auth)

9674 (ASD-TDR-62-451) PROPERTIES OF PLASMAS AS THEY PERTAIN TO THERMAL ARC-JETS. (Plasmadyne Corp., Santa Ana, Calif.). Aug. 1962. Contract AF33(616)-8173. 136p.

A study was conducted to obtain information which will aid in selecting propellants for use in electrothermal engines. Several potential propellants were examined. These include H_2, ammonia, He, LiH, N_2, CH_4, air, Ar, and Li. Discussions of important propellant properties and their effect on engine performance and life are presented. The effect of the propellant choice on the operation of the arc-jet is considered. This includes examining theoretical thruster efficiency, engine life, and the effect of the engine's mission. Experiments were performed for eight propellants using a 1-kw engine. The results of these tests are discussed. (auth)

9675 (BSD-TDR-62-237) A SURVEY OF DIAGNOSTIC METHODS FOR IONIZED GASES USING MAGNETIC FIELDS. R. Betchov and A. E. Fuhs (Aerospace Corp. Physical Research Lab., El Segundo, Calif.). Sept. 21, 1962. Contract AF04(695)-169. 32p. (TDR-169(3153) TR-1)

A number of instruments designed to probe the plasma sheet during reentry or any other plasma flow are described. The instruments produce magnetic fields and respond to the currents induced in the plasma as it cuts through the magnetic field. The set of instruments can measure: an averaged value of the product of conductivity times velocity, a profile of the same product, the local flow direction, an averaged flow velocity, and certain turbulent fluctuations. Another instrument, now being developed, will measure an average value of the electron-neutral collision frequency. Flight instruments and laboratory instruments are briefly described. Calibration procedures are outlined. (auth)

9676 (MATT-Q-19) QUARTERLY REPORT [ON PROJECT MATTERHORN], APRIL 1–JUNE 30, 1962. (Princeton Univ., N. J. Plasma Physics Lab.). Aug. 14, 1962. Contract AT(30-1)-1238. 40p.

The phenomena occurring in Model C Stellarator after the end of the ohmic heating pulse were investigated. A current of runaway electrons, amounting to some 50 amp, persisted for about 0.10 sec. The hydrogen that went to the wall during ohmic heating was observed to start returning after a few milliseconds. Studies of the B-3 device were continued with Langmuir probes. Detailed ion temperature measurements on B-66 were made both with a diamagnetic loop and a magnetic ion energy analyzer. The peak temperature of about 250 ev was reached at a field some 10% greater than the field for cyclotron resonance of a free ion. A program was begun to see whether plasma loss in Etude can be definitely related to plasma noise. The first results indicated that within the column the enhanced diffusion resulting from the noise is high indeed. In the Q-1 a barium plasma was produced by allowing a barium molecular beam to impinge on a hot rhenium plate. The Q-3 device, a cesium plasma source, was put into operation. Studies were made of a plasma gun preparatory to the possible use of such guns with Model C. With an electrostatic ion analyzer, combined with time-of-flight discrimination, the impurity level was measured to be about 25%. Engineering and development of the stellarators are discussed. Theoretical studies on the instabilities in spatially inhomogeneous plasma are described. (M.C.G.)

9677 (ML-897) A VARIATIONAL TECHNIQUE FOR DETERMINING THE PROPAGATING MODES OF A FINITE PLASMA. Scientific Report No. 40. S. S. Jha and G. S. Kino (Stanford Univ., Calif. Microwave Lab.). Mar. 1962. Contract AF19(604)-1930. 46p. (AFCRL-62-176; AD-277407)

The use of a variational method to determine the propagating characteristics of a slow wave mode along a finite plasma column of nonuniform density is described. Rayleigh-Ritz procedures are used to determine the best approximation for the r-f field variation over the cross section. For this purpose, a set of Jacobi orthogonal polynomials is constructed which are orthogonal over the cross section of the plasma. Both the d-c density variation of a plasma and the r-f field variations within the plasma are expressed in terms of this set of polynomials. This procedure yields results in good agreement with an exact field theory in the range $\beta a < 2$, where β is the propagation constant. The propagating characteristics depend on the average value of the density within the column. (auth)

9678 (NASA-TN-D-1689) HYDROMAGNETIC WAVE PROPAGATION IN A CONSTANT DIPOLE MAGNETIC FIELD. John Carstoiu (Sylvania Electric Products Inc., Waltham. Mass.). Dec. 1962. For National Aeronautics and Space Administration, Washington, D. C.). Contract NASr-18. 35p.

Basic concepts are presented, and a theorem of decomposition for the rate of change of the magnetic field similar to the Cauchy-Stokes decomposition theorem in hydrodynamics is included. A theory of magnetohydrodynamic waves in the presence of a uniform magnetic field is presented, and some details on the geometry of dipole magnetic lines of force are discussed. Magnetohydrodynamic waves in a constant dipole magnetic field are also considered. (auth)

9679 (NP-12372) THE BOUNDARY LAYER OF A CONDUCTING VORTEX FLOW OVER A DISK WITH AN AXIAL MAGNETIC FIELD. W. S. Lewellen and W. S. King (Aerospace Corp., El Segundo, Calif.). Dec. 7, 1962. 45p.

The interaction of the boundary layer, produced by the vortical flow of a viscous, incompressible, electrically conducting fluid over a stationary disk, with a magnetic field that is aligned with the vortex axis, is considered. The relation of this problem to both the magnetohydrodynamic vortex power generator and the hydromagnetic capacitor is discussed. The boundary layer equations are solved by two approaches. First, a momentum integral technique is used to gain estimates of the flow behavior over a finite disk. Second, conditions necessary for similarity over an infinite disk are investigated and the equations appropriate to this case are derived. The similarity equations are solved analytically for cases of strong magnetic interaction. The profiles obtained from the similarity solution are used for a discussion of the appropriateness of the approximate profiles assumed in the foregoing momentum integral method. The flow outside of the boundary layer is assumed to be that of a strong vortex in which the streamlines are nearly circular. In such flows, it is shown that the boundary-layer development will in many cases be purely hydrodynamical even when the flow outside the boundary layer is governed by magnetohydrodynamic effects. (auth)

9680 (NP-12378) A CORRELATION STUDY OF PLASMA DIAGNOSTIC TECHNIQUES (thesis). Robert Roscoe Murfitt (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio). May 1962. 67p. (GNE/Phys/62-11)

The ratio of the real to the imaginary conductivity of a neutral plasma can be determined in several ways. If the velocity distribution and the collision frequency of the electrons in the plasma are known, this conductivity ratio can be calculated; and if the plasma is confined in a microwave cavity, measurements of the power which enters and emerges from the cavity can also be used to calculate this ratio. This gives two independent methods of calculating the same quantity, the conductivity ratio. A cylindrical microwave cavity that could be filled with a Hg plasma was designed and built in such a way that spherical Langmuir probes could be inserted into the plasma in the cavity. The spherical probes were used in an attempt to determine the velocity distribution function of the electrons, but the lack of results from the probes made it necessary to assume a Half-Maxwellian distribution function existed within the cavity. Microwave measurements of the conductivity ratio agreed with the conductivity ratio which was calculated from the assumed distribution function, but the large standard deviation in the microwave measurements indicates that further refinements in design are necessary. The probability of collision of the electrons in Hg vapor is such that the effect of the electron velocity distribution function on the conductivity ratio is minimized, and the re-design of the equipment for use with a rare gas plasma is necessary before the microwave measurement of the conductivity ratio can be used to confirm that a given distribution function exists in the plasma. (auth)

9681 (AGARD-320) GAS-PLASMA RESEARCH AT THE INSTITUTE FOR THERMODYNAMICS, BRAUNSCHWEIG. F. Bošnjaković, W. Springe, and K. F. Knoche (North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development). Sept. 1959. 14p.

Problems of thermal equilibrium of a plasma gas, for temperatures up to 100,000°K are discussed. The effects of enclosed radiation at temperatures beyond 20,000°K, which can be very significant, are considered. Plasma heat-transfer problems are dealt with. (auth)

9682 (NP-12382) ENERGY BALANCE OF A WHIRL STABILIZED HYDROGEN ARC (thesis). Thomas E. Reinhardt (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio). July 1962. 66p. (GNE/Phys/62-15).

A whirl stabilized hydrogen arc existed in a transparent vycor tube between flat copper electrodes, each having axial gas discharge holes. An investigation was made to make an energy balance on this arc by the method of water calorimetry. The total energy balance revealed questionable stability below ninety amperes. A marked hysteresis was observed sixty and ninety amperes by varying chamber pressure. The initial increase of power at constant pressure led to a positive voltage-current characteristic. Enthalpy ranged from 30,000 to 70,000 Btu/lb. Efficiency varied from 80 to 90%. Electrode losses were optimized by decreasing the cathode discharge hole diameter. Suggestions for improvements leading to higher enthalpy, stability, and lifetime are included. (auth)

9683 (NP-12456) BOUNDARY VALUE PROBLEMS IN PLASMA OSCILLATIONS (thesis). Fred Charles Shure (Michigan. Univ., Ann Arbor). [1962]. 111p.

A unified treatment is presented for boundary value problems involving a plasma whose singlet phase-space density satisfies the linearized form of the Landau-Vlasov equation. A normal mode expansion is used in the singular eigenfunctions of the coupled Maxwell and Landau-Vlasov equations. The various derivations of the Vlasov equation are outlined. Normal-mode solutions of the coupled equations are derived for the case of transverse waves of fixed frequency. Reflection of electromagnetic radiation from a

plasma half-space and slab is considered along with the case where the plasma is located in a steady-state magnetic field. Other problems considered are the initial value problem for transverse modes, Landau damping, and longitudinal oscillations. (D.L.C.)

9684 (PAN-321/IX) VZAIMODEISTVIE PLAZMENNOGO TZILINDRA S VYSOKOCHASTOTNYM ELEKTROMAGNITNYM POLEM. (Interaction of H. F. Electromagnetic Field with Plasma Cylinder). Stefan Khvashchevski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Apr. 1962. 13p.

The interaction of a h-f electromagnetic field with a long plasma cylinder was considered. Using an analog computer the current distribution of electric and magnetic fields along cylinder radius by formation of skin loger was solved. (auth)

9685 (R62SD14) MACROSCOPIC EQUATIONS GOVERNING THE INTERACTION OF ELECTROMAGNETIC WAVES WITH NON-UNIFORM PLASMA FLOWS. K. T. Yen (General Electric Co. Missile and Space Div., Valley Forge Space Technology Center, King of Prussia, Penna.). Sept. 1962. 16p.

A method of analysis for the interaction between electromagnetic waves and a non-uniform plasma flow is presented. The electromagnetic waves are taken to be in the microwave range. By using a full-ionized gas as a model, two coupled sets of macroscopic equations are obtained: the flow equations and the field equations. Special consideration is given to the case where diffusion and charge separation can be disregarded. It is shown that both sets of equations can be reduced to useful forms. Physical significance of these equations and extension of this method to include charge separation and partially ionized plasmas are briefly discussed. (auth)

9686 (TID-17028) STUDIES OF PLASMA OSCILLATIONS. Quarterly Status Report No. 11, June 1 – August 31, 1962. (Stanford Univ., Calif. Microwave Lab.). Oct. 1962. Contract AT(04-3)-326. 25p. (ML-959)

The dipole resonance technique for measuring the number density and its fluctuations was improved by placing shorting rings around the plasma column on either side of the strip line. The theory of multipole resonances of a plasma column is discussed. Measurements of the amplitude and phase of the a-c density fluctuations at constant a-c current were made as a function of frequency, and the results agree with theory. Auxiliary electrode experiments were carried out to study the role of the cathode region and the generation of additional noise. The dipole resonance method was used in measurements of noise variations along the positive column in a hot mercury tube. The dependence of noise fluctuations of density on circuit impedance was studied. (D.L.C.)

9687 (TID-17475) PLASMA PHYSICS RESEARCH (THEORETICAL). Progress Report, October 1962. Marshall N. Rosenbluth (California. Univ., La Jolla). Contract AT(11-1)-34. 73p.

Previous calculations of synchrotron radiation from plasmas assumed that the formulas for single particle emission could be properly used, thus neglecting collective effects. By use of the Kirchhoff relations it can be shown that this is valid in the limit $\omega^2 >> \omega_p^2$. An expansion of the radiation loss in powers of ω_p^2/ω^2 was carried out. The dominant contribution was found to arise from the modification in the wave number $k^2c^2 = \omega^2 - \omega_p^2$ as it occurs in the arguments of the Bessel Function $I_n(k^2v^2/\Omega^2)$ which describe the n^{th} harmonic content of the gyrating relativistic electron. This led to a reduction of radiation by a factor $(1 - \omega_p^2/n\omega^2)$, indicating that over most regions of thermonuclear interest the single particle results are indeed valid. A heuristic derivation of Bremsstrahlung was also given from the Fokker-Planck equation including the corrections near the plasma frequency. An attempt was made to extend the theory of the structure of the magnetic piston (boundary between a field free plasma and a vacuum field) without trapped particles. It is shown that no possible solutions exist for most plasma distribution functions. This is true because the electrostatic potential which turns back the ions always decreases electron density by a larger amount as a result of accelerating those electrons traveling nearly parallel to the boundary. The trapping mechanism is being studied as is the stability of thin sheaths. A large class of micro-instabilities were previously studied with the collisionless Boltzmann equation. It was customary to estimate the collisional damping by use of the phenomenological collision rate, ν. This, however, may lead to an overestimate of the collisional damping since the effects of collisions are constrained by the conservation laws. Therefore, a slightly modified form of the collisional interaction which always relaxes the distribution to a locally Maxwellian one was applied. Magnetic mirror machines were studied with reference to the possible stabilization of the flute instability. The effect of externally produced shear such as might result from a hard core or Joffe windings was investigated. A rough model calculation was performed of a finite length hard core pinch with the destabilizing effect of the minor field stimulated by a radial gravity and using the magnetohydrodynamic approximation. This indicated that the only effect of the shear produced by a $(1/\Gamma)$ B_θ field was to reduce the growth rate of the flute modes, the B_θ field having no effect on the question of stability. A calculation is under way using the zero-Lamor radius energy principle on the actual mirror geometry. A study was made of the effect of introducing finite resistivity into magnetohydrodynamic equations. The most important effect is to relax the constraint that fluid always remains attached to field lines which changes the topology of possible motions. In particular, it was found that in the neighborhood of surfaces where $\vec{k}.\vec{B}_0 = 0$ the restoring motor force (which would be infinite for perfect conductivity) becomes small for finite conductivity. This local relaxation of the magnetohydrodynamic constraint leads to three characteristic types of instability: the tearing mode due to a tendency of the fluid to break up into localized pinch structures, the rippling mode due to resistivity gradients, and, in the presence of gravity, a gravitational instability in cases which would ordinarily be shear stabilized. In all cases the growth rate is roughly the geometric mean between characteristic hydrodynamic rates and characteristic diffusive rates. (auth)

9688 (UCRL-6868) RESEARCH NOTE ON THE HARRISON-THOMPSON GENERALIZATION OF BOHM'S SHEATH CONDITION. Laurence S. Hall (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 16, 1962. Contract W-7405-Eng-48. 5p.

Harrison-Thompson's generalization of Bohm's condition for the formation of a sheath in the low-pressure plane symmetric discharge is discussed, and their claim that the analysis is applicable to an arbitrary incident ion velocity distribution is criticized. Their expansion of the square root under the integral $n_+(z) = \int_0^\infty dv\ v\ (v^2 + 2\ kT_e\ \Delta n/M)^{-\frac{1}{2}}\ f(v,z_b)$ is shown to diverge for all distributions $f(v,z_b)$ for which $\delta^p f/\delta v^p$ does not vanish at $v = 0$. A corrected analysis is developed in which the integral is the sum of two integrals. The physical interpretation of the

results is discussed, and it is concluded that Bohm's simpler model can be used. (D.L.C.)

9689 (UCRL-7033) ION DENSITY VERSUS TIME IN THE ALICE AND PHOENIX EXPERIMENTS. John R. Hiskes and C. Bruce Tartar (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 26, 1962. Contract W-7405-eng-48. 29p.

Solutions of the ion density versus time are presented for the case of neutral injection into the Alice and Phoenix mirror machines. The solutions are given for a range of parameters such as base pressures covering the range from 10^{-8} to 10^{-11} mm Hg, plasma containment volumes whose longitudinal dimensions range from the injection beam width to the mirror-to-mirror distance, and neutral beam currents which are integral multiples of 50 ma. The contribution of Lorentz ionization to the ion density is compared with the ion densities owing to gas collisions. It is concluded that if the effects of Lorentz ionization are fully utilized, the requirements on base pressure and beam current necessary to achieve significant ion densities are considerably relaxed. (auth)

9690 (AD-276705) WAVES ALONG HOMOGENEOUS PLASMA LAYERS. W. O. Schumann. Translated by Paul D. Maffeo from p.255-61 of "Proceedings of the Mathematical and Natural Science Division of the Bavarian Academy of Sciences, held in Munich, 1948." 7p.

The Maxwell equations are applied to the case of E-waves in an infinite plasma layer. The special case of plasma layers between atmosphere layers is considered. (D.L.C.)

9691 (FTD-TT-62-508) PLASMA — THE FOURTH STATE OF MATTER. D. A. Frank-Kamenetskii (Frank-Kamenetskiy). Translation of "Plazma — Chetvertoye Sostoyaniye Veshchestva" (a publication of the State Publishing House of Literature on Nuclear Science and Technology, Moscow, 1961). 192p.

Basic concepts of plasma physics are discussed with special reference to the model of a continuous conducting medium (magnetohydrodynamics) and to the motion of the individual charged particles (physical kinetics). Other information is included concerning plasma oscillations, instability, magnetic compression, and acceleration. (J.R.D.)

9692 (UCRL-Trans-867(L)) ON FLUCTUATIONS OF THE ELECTROMAGNETIC FIELD IN A NON-EQUILIBRIUM PLASMA. L. S. Bogdankevich, A. A. Rukhadze, and V. P. Silin (Akademiya Nauk S.S.S.R. Institut Fiziki im. P. N. Lebedeva). Translated by Sergey Shewchuck (Univ. of California, Lawrence Radiation Lab., Livermore) from Report A-80. 1962. 17p.

Fluctuation of the electromagnetic field in a stable non-equilibrium plasma was investigated, especially for non-isothermal plasma and for a system of mutually penetrating beams. Spatial and time correlative functions of the electric field were found for a non-isothermal plasma. The spectral density of the fluctuations was studied for the electric field in the system of mutually penetrating beams. It was found that during approach of the velocity of the beams to some critical value, which corresponds to an excitation condition of kinetic instabilities, the fluctuations of the electromagnetic field grow indefinitely in such a plasma. (auth)

9693 STABILITY OF A PLASMA IN AN INHOMOGENEOUS MAGNETIC FIELD. B. Lehnert (Royal Inst. of Tech., Stockholm). Arkiv Fysik, 22: 445-7(1962). (In English)

The stability of a plasma supported by a magnetic field against its own pressure or against a gravitation or centrifugal force has been studied earlier. It was found that, under certain circumstances, density perturbations in the plasma will move in a way to produce an electric field which in its turn generates a drift motion and a growing amplitude of the perturbations. The stability treatment is extended in several respects. (W.D.M.)

9694 THE EFFECT OF LOCAL DISTURBANCES OF THE MAGNETIC FIELD ON THE CONFINEMENT OF PLASMA IN AN ADIABATIC MAGNETIC TRAP. N. N. Brevnov and Yu. F. Tomachuk (At. Energ. (USSR), 13: 421-8(Nov. 1962). (In Russian)

Experiments indicated that the extended confinement of the ions in a magnetic trap is not compatible with the degradation of the axial symmetry of the field; dishomogeneities of the field were found to become lower considerably the duration of the confinement. Tests carried out during confinement with the adiabatic magnetic trap "Ogrenok" showed that escape of fast ions at the walls and the closure originated primarily at the region of the magnetic channel. The escape was caused by the scattering of ions on the local disturbance created by the magnetic channel of the field. The dimensions of the disturbance were measured. Replacement of the magnetic field by an electrostatic one resulted in a sudden decrease of the fast ion current removed by the wall but no preferential points of the escape of the ions could be distinguished. In measuring the parameters of the fast ion scattering by creating controlled disturbances, it was found that the presence of local disturbances of the magnetic field results in changes of the angle formed by the velocity vector and the normal to the lines of force by several degrees. The disturbances also caused a shift of the Larmor centers of the ions across the magnetic field by a distance of the order of the Larmor radius. (TTT)

9695 STABILIZATION OF LOW-PRESSURE PLASMA BY A HIGH-FREQUENCY FIELD. T. F. Volkov and B. B. Kadomtsev. At. Energ. (USSR), 13: 429-34(Nov. 1962). (In Russian)

The possibility of stabilizing plasma boundaries by means of a high-frequency electromagnetic field was investigated for a plasma confined by an undulating field. Such a plasma is unstable because it is thrown to the walls of the trap. The stablizing high-frequency field should be applied preferably at the convex region of the lines of force, where the absolute value of the magnetic field decreases with the distance from the axis; in the case of groove-shaped disturbances with a stationary magnetic flux within the plasma its transversal cross section increases. In that case the plasma must act against the high-frequency field, exerting a stabilizing effect. On the other hand, in the concave region the cross section of the plasma decreases and resonators placed in this region will enhance the instability. In these considerations it was assumed that application of the high-frequency field does not change the equilibrium boundary of the plasma; this condition is fulfilled only if the pressure of the high-frequency field is lower than the plasma pressure. (TTT)

9696 LOCAL FIELD DISTURBANCES IN MAGNETIC MIRROR TRAPS. A. V. Nedospasov. At. Energ. (USSR), 13: 472-3(Nov. 1962). (In Russian)

Disturbances, such as those created in the "Ogra" and "Ogrenok" assemblies by ion injection, in the magnetic field of the trap may lead to changes of the adiabatic invariant $I = v^2_{\perp}/H$. These changes were evaluated in the case of the scattering on a small dipole disturbance, the moment of which is parallel to the main field. It was

found possible to estimate the magnitude of the disturbance leading to the escape of particles from the trap beyond a certain number of reflections N for the stochastic case when $\overline{\Delta I^2} = \overline{\delta I^2}N$. For the "Ogra" machine, this amounts to 20 to 30 thousand reflections. (TTT)

9697 CONCERNING ELECTROMAGNETICALLY PRODUCED COMPRESSIONS OF HIGH MACH NUMBER. W. Fucks, J. Czech, and P. Nelting (Technische Hochschule, Aachen). Atomkernenergie, 7: 447-9(Dec. 1962). (In German)

Research progress on electromagnetically driven shock waves in helium is reported. A description of the experimental setup is given and the generation of a shock by compressing a plasma in a conical coil described. Planarity of the luminous front is shown by streak-camera records and discussed as a function of initial pressure of the shock tube. The front-velocity as a function of distance from the generating coil with the pressure as parameter is given as measured by streak-photographs. It ranges between Mach 10 and 100. Light from and behind the luminous front was spectroscopically analyzed as a function of time to allow calculation of electron-densities and temperatures. Measurements of axial magnetic field strength show that a magnetic dipole is travelling with the luminous front. (auth)

9698 POSSIBILITY OF A COLLISIONLESS SHOCK IN A TWO-FLUID SYSTEM. Soubbaramayer. Compt. Rend., 255: 1691-3(Oct. 8, 1962). (In French)

In his study of magnetodynamic shock waves by a continuous two-fluid theory, Marawetz (NYO-8677) excludes, for reasons of continuity, the possibility of a shock solution leading to a state below subsonic. It is shown that such a solution can exist even in the absence of all dissipation, but it is not continuous and has an internal discontinuity. It is the extension to the two-fluid system of the phenomenon of sub-shock already found by P. Germain (ONERA-97) in the one-fluid system. The technique consists of introducing a viscosity and then making it approach zero. (tr-auth)

9699 A SHOCK WAVE SCHEME IN FLUID MAGNETODYNAMICS. Paul Germain and Soubbaramayer. Compt. Rend., 255: 1856-8(Oct. 15, 1962). (In French)

The result reported by Soubbaramayer (Compt. Rend., 255: 1691(1962)) was generalized to the case where the conductivity is finite and the law of the fluid state is arbitrary. (tr-auth)

9700 VELOCITY OF THE IONIZATION FRONT IN A NEON COLUMN EXCITED BY ULTRA-HIGH FREQUENCIES AT ONE END. Claude Maleval and Jean Collomby (Laboratoire de Physique de Sud-Aviation, [France]. Compt. Rend., 255: 1896-8(Oct. 15, 1962). (In French)

A uhf wave train at 3 bHz, lasting 1 μsec, ionizes strongly several cubic centimeters of neon at the end of the tube. The free boundary of this excited volume advances at a velocity of the order of 10^3 km/sec, the velocity being studied as a function of the pressure. For a given excitation frequency f, a characteristic pressure p_c appears on both sides, whose boundary velocities V obey different laws. (tr-auth)

9701 AN EXPERIMENT ON CONFINEMENT BY A BIPOLAR MAGNETIC FIELD TURNING AT HIGH FREQUENCY TRANSVERSELY TO A STATIC MAGNETIC FIELD. René Mérard and Jacques Pottier (CEN, Saclay, France). Compt. Rend., 255: 1899-1901(Oct. 15, 1962). (In French)

The experimental apparatus used is briefly described, and the results obtained are discussed. Permanent plasmas could be attained with electron temperatures of 400,000°K and densities of 5×10^{10} electrons/cm^3. (tr-auth)

9702 DIFFUSION OF ELECTRONS BY TEMPERATURE GRADIENT IN PLASMA OF POSITIVE COLUMN. L. Pekárek and V. Krejčí (Inst. of Physics, Czechoslovak Academy of Science, Prague). Czech. J. Phys., 12: 815-20(1962). (In English)

The inhomogeneous distribution of the concentration of charge carriers in a plasma as a rule causes a deflection of the electron temperature from the equilibrium state by means of a series of interconnected phenomena. In addition to the concentration gradient and the electric field, the temperature gradient also has an influence on the diffusion of electrons. It is shown that in the conditions of the positive column of a d-c discharge the electron diffusion caused by a temperature gradient is in the same order of magnitude as the diffusion caused by a concentration gradient. (auth)

9703 THE INFLUENCE OF OSCILLATIONS ON IONIZATION IN A DISCHARGE PATH. J. Habanec (Nuclear Research Inst., Czechoslovak Academy of Science, Rez). Czech. J. Phys., 12: 821-32(1962). (In English)

The problem of gas ionization in a discharge path in a very dilute gas is solved, where the free path of the electrons is much larger than the dimensions of the path and the transit time of the electrons between the electrodes is of the order of the period of the applied h-f voltage. It is found that for a certain ratio of the transit time of the electrons between the electrodes in the discharge path to the period of the h-f oscillation, resonance occurs when the reactive current component is zero. The electron density rises in the path and thus also the gas ionization. (auth)

9704 THE INSTABILITY OF ALFVÉN WAVES. A. A. Galeev and V. N. Oraevskii (Novosibirskii State Univ., USSR). Dokl. Akad. Nauk SSSR, 147: 71-3(Nov. 1, 1962). (In Russian)

In magnetohydrodynamics, it is believed that Alfven waves can exist for a long time without a change in form, but it can be shown that Alfven waves are unstable with respect to perturbations containing not only Alfven waves but also magnetoacoustical waves. The stationary state is taken as an Alfven wave, for which the magnetic field H cos k_0 r′ (where r′ = r − ut, u = the wave velocity) and the hydrodynamic velocity V cos k_0 r′ are perpendicular to the direction of propagation k_0 and to the unperturbed magnetic field H_0. The linear equations for the perturbations involve v, h, n, and p, which are the perturbations of the velocity, magnetic field, density, and pressure, respectively. The terms v, h, n, and p do not depend on time and can be represented in the form $e^{-i\omega t}$. It is assumed that $k_1 = k_0 + k_2$ and that $\omega_1^{(0)} = \omega_0 + \omega_2^{(0)}$, where ω_0 is the frequency of the "background" oscillations. A set of algebraic equations for the wave amplitudes is derived by perturbation theory, and the stability of Alfven waves with respect to various types of disturbances is investigated. If the disturbance consists of a set of Alfven and magnetoacoustical waves, the initial Alfven wave is unstable at some angle of propagation with respect to the magnetic field. The order of magnitude of the increment $\nu = -i\omega$ for the increase of a small perturbation in the form of an Alfven wave and a slow magnetoacoustical wave is equal to: $\nu \cong (V\omega_0)/(8uv_s)^{0.5}$. The increment for the rise of the perturbation is the same order as ν, if a fast magnetoacoustical wave is involved in the perturbation instead of an Alfven wave. Thus, an Alfven wave is converted into disordered oscillations of the medium within a time of the order of $1/\nu$. (TTT)

9705 A STUDY OF PLASMA ESCAPE THROUGH MAGNETIC TRAP SLITS WITH THE FIELD INCREASING TOWARDS THE PERIPHERY. L. L. Gorelik, N. G. Koval'skii, I. M. Podgornyi, and V. V. Sinitsyn. Dokl. Akad. Nauk SSSR, 147: 576-9(Nov. 21, 1962). (In Russian)

A magnetic field was created in the trap of the "OREKH" by four coaxial coils. The shape of the magnetic force lines was cusp-like with a quadrupole arrangement of the coils, and was characterized by a relatively gradual change in the direction of the force lines. With an "octopole" arrangement of the coils, the field changes direction abruptly, and decreases toward the center. The energy of the injected plasma beam was measured with a hollow cylindrical calorimeter 82 mm in diameter and 50 mm high. The evolution of heat on the wall was followed as a function of time by means of special, thermistor bismuth-lead bolometers with a resolving time of 3 μsec. Sensitive germanium bolometers were used to measure small heat fluxes in a dilute plasma. The threshold sensitivity of a triple-layer, bismuth bolometer 0.2 μ thick, used for time measurements at low plasma concentrations, was 10^{-5} joules/cm^2. Langmuir probes gave an electron temperature of 15 ev close to zero magnetic field. The ion temperature was ~10 ev at H_0 = 4000 oersteds, as determined from the Doppler widening of the HeII and CII lines. The width of the magnetic slit was greater at H_0 = 2000 than at H_0 = 4000 oersteds for both coil configurations. Experiments with a calorimetric probe inside the vacuum chamber with an octopole coil arrangement showed that the charged particles escape by falling into the weak magnetic field near the center (the dimensions of region with a weak magnetic field are ~5 cm). With a quadrupole arrangement, the plasma trapped in the magnetic field escapes along the magnetic force lines. (TTT)

9706 QUASILINEAR EQUATIONS FOR A QUANTUM PLASMA. A. A. Vedenov. Doklady Akad. Nauk SSSR, 147: 334-7(Nov. 11, 1962). (In Russian)

Quasilinear equations are derived for a quantum plasma in studying the turbulence of a plasma of solid carriers. The equations, which were obtained by assuming a self-consistent field, are very simple. These equations have the form of kinetic equations for an almost ideal system of boson "waves" and fermion "particles," if it is assumed that the only process taking place in the system is the emission (or absorption) of a "wave" or "particle." The density of the "waves" N_k is large, so that the matrix elements for the process of absorption and emission are proportional to $\sqrt{N_k}$. The change in number of "particles" F_p in momentum space p due to absorption and emission is as follows: (a) the "removal" due to absorption is: $-\Sigma_k F_p N_k W_{p,p+k} \delta(\epsilon_p + \omega_k - \epsilon_{p+k})$; (b) the "removal" due to emission is: $-\Sigma_k F_p N_k W_{p,p-k} \delta(\epsilon_p - \omega_k - \epsilon_{p-k})$; (c) the "arrival" due to absorption is: $\Sigma_k F_{p-k} N_k W_{p-k,p} \delta(\epsilon_{p-k} + \omega_k - \epsilon_p)$; and (d) the "arrival" due to emission is: $\Sigma_k F_{p+k} N_k W_{p+k,p} \delta(\epsilon_{p+k} - \omega_k - \epsilon_p)$. Here $W_{p',p} = W_{p,p'}$ is the probability of absorption with transition of a "particle" from state p to the state p'. The term $\epsilon_p = p^{2m}$ is the energy of the "particle" and ω_k is the energy of the "wave." An equation for F_p is obtained by summing the contributions of (a) to (d). Also, in an analogous fashion, an equation is derived for the change in density of the "waves" N_k due to absorption and emission. (TTT)

9707 THE ASYMMETRY OF THE SPECTRAL LINES OF HYDROGEN IN A PLASMA. L. P. Kudrin and G. V. Sholin. Doklady Akad. Nauk SSSR, 147: 342-5(Nov. 11, 1962). (In Russian)

With a density of charged particles of $N \cong 10^{17}$ cm^{-3} in a plasma, a change in intensity at the maximum is ~10% for the H_β line. This asymmetry and the distance between the line maxima are functions of the charge component in a plasma and can be used to measure the density of charged particles in a plasma. If the lifetime of an atom in a given Stark sub-level is small in comparison with the time of the observed shift in an ion, the following equality can be written: $N^{0.67} \gg \sqrt{m/M}\,(1/\pi n^4 \lambda_e^3)$. Here m/M is the ratio of the electron mass to the mass of the proton, n is the principal quantum number, and λ_e is the Debye wavelength of the electrons causing the shift. At $T \cong 1$ ev and $N > 10^{15}$ cm^{-3}, the above inequality holds. The energy of interaction of the ion with an atom is taken into account, and it is shown that the shift in the Stark component due to the quadrupole term is proportional to n^4. Relative changes in intensity ΔI at the maxima were calculated for the H_β line for various values of N. The values of ΔI are 4.6% for $N = 10^{16}$, 7.6% for $N = 5 \times 10^{16}$, 9.8% for $N = 10^{17}$ and 23.3% for $N = 10^{18}$ cm^{-3}. These values are in good agreement with the experimental values. The calculated shifts in the maxima with respect to the line center (Δλ) are also presented. This method of measuring the density of a plasma may turn out to be more accurate than the method of measuring the density from the line width. (TTT)

9708 PLASMA FOURTH STATE OF MATTER. Ind. Eng. Chem., 55: 16-23(Jan. 1963).

The characteristics and uses of plasma jets, plasma torches, and plasma arcs are described. The use of plasma to induce and alter chemical reactions is discussed. (T.F.H.)

9709 GUIDING OF ELECTROMAGNETIC WAVES ALONG A MAGNETIC FIELD IN A PLASMA. M. S. V. Gopal Rao and H. G. Booker (Cornell Univ., Ithaca, N. Y.). J. Geophys. Res., 387-94(Jan. 15, 1963).

Using ray theory and assuming longitudinal propagation conditions, the circumstances in which curvature of the ray is identical with curvature of the magnetic field are investigated. In general the two curvatures are only identical if there exists an appropriate transverse gradient of the plasma density. For a given ratio of the wave frequency to the gyrofrequency, and of the plasma frequency to the gyrofrequency, the necessary transverse gradient of plasma density may be calculated as a ratio to the curvature of the magnetic field. Curves have been prepared showing, for a wide range of values of the parameters, the transverse gradient of plasma density required to make the ray curvature identical with the field curvature. Of particular interest are the conditions in which no transverse gradient of plasma density is required to make the ray curvature identical with the field curvature. In these circumstances waves are guided by the magnetic field even in a homogeneous plasma. It is found that at hydromagnetic frequencies (wave frequency less than the ionic gyrofrequency) such guiding never occurs. Indeed, at frequencies small compared with the ionic gyrofrequency the ray curvature is equal to the field curvature in magnitude but opposite in sign. Above about twice the ionic gyrofrequency, field guiding is possible in a homogeneous plasma for the left-hand wave (O wave) but not for the right-hand wave (X wave), provided that the homogeneous plasma density is adjusted to an appropriate value. (auth)

9710 CYCLOTRON RADIATION OF A PLANE BOUNDARY BETWEEN A PLASMA AND A MAGNETIC FIELD. H. Burkhardt (New York Univ., New York). Nucl. Fusion, 2: 1-5(Sept. 1962). (In English)

In order to calculate the cyclotron radiation of a plane boundary between a non-relativistic field-free Maxwellian

plasma and a homogeneous vacuum magnetic field, it is first necessary to ascertain the transition function. While the general solution of this problem is not yet known, H. Grad has given a solution for a collisionless plasma neglecting the electric field between electrons and ions. A numerical evaluation of Grad's formula is given. Based on this result, the cyclotron radiation of an electron impinging on the boundary is calculated. The total cyclotron radiation of a unit area of the boundary is found to be proportional to the $^3/_2$ power of the density and to the square of the temperature. If magnetic field is excluded from a plasma, except for the thinnest possible transition layer, it is found by comparison with bremsstrahlung that cyclotron radiation losses of a magnetically confined plasma are negligible except for an extremely high temperature, low density plasma. (auth)

9711 STABILITY OF A ROTATING PLASMA. H. E. Wilhelm (Technische Hochschule, Stuttgart). Nucl. Fusion, 2: 6-11(Sept. 1962). (In English)

The stability of a uniformly rotating cylindrical plasma-configuration in dynamical equilibrium with a surrounding uniformly rotating gas is investigated by the method of small perturbations. Neglecting dissipation mechanisms and assuming a sheet current for the plasma, it is shown that the system is dynamically stable if at the boundary the rotational energy density of the exterior gas is greater than, or at least equal to, the sum of the rotational energy density of the plasma and the energy density of the azimuthal magnetic field. Stability may be obtained up to extremely high currents for large angular velocities and large mass densities of the exterior medium. Beyond the stability condition the system is dynamically unstable. The dispersion of the instabilities is discussed. (auth)

9712 HYDROMAGNETIC EQUILIBRIA AND THEIR PROPER COORDINATES. Shigeo Hamada (Nihon Univ., Tokyo). Nucl. Fusion, 2: 23-37(Sept. 1962). (In English)

Proper coordinate systems are constructed in hydromagnetic equilibria and their properties are studied. First, the contra-gradient components of magnetic field and of current density are surface quantities. Second, the equi-pressure surfaces which have no singularity within a finite volume must be topologically torus-shaped. Third, a general condition of no charge separation is deduced as follows: There must be a simple closed loop on every equi-pressure surface having the property that the integral $\int_A^B dl/H$ is constant for the variable A. Here, the integral is carried out along a magnetic line from a point A on the loop to the returning point B on the same loop, and dl is the magnetic line element. An expression of the shape of current lines is obtained from the condition in the cases of unclosed field and of twisted field. A method of determining the magnetic surfaces which coincide with equi-pressure surfaces is obtained in the case of closed field. The successive approximation method developed by M. Kruskal et al. is examined with the help of these methods. It fails in the first approximation in almost all cases of twisted fields. It can be used in the case of unclosed field if the rotational transform ratio is one of the continued fractions constructed. It can be used in the case of the closed field with mirror symmetry when the plasma pressure gradient is not too steep. An effect of the closed magnetic lines in a twisted field is considered. The diffusing velocity of plasma is infinite in the neighborhood of magnetic surfaces which are made of closed lines not satisfying the condition of no charge separation. The ratio of the measure of the highly diffusing region to the measure of the whole system is estimated in an easy case. The result suggests that the confinement time of plasma may be considerably shorter than that of plasma in the field compatible with the condition of no charge separation. (auth)

9713 ELECTRIC AND MAGNETIC DISSOCIATION AND IONIZATION OF MOLECULAR IONS AND NEUTRAL ATOMS. John R. Hiskes (Univ. of California, Livermore). Nucl. Fusion, 2: 38-48(Sept. 1962). (In English)

The dissociation and ionization of molecular ions and neutral atoms by the Lorentz force provide a mechanism for trapping energetic particles inside fusion machines without need for ionizing collisions on background gas molecules or arc discharges. At ion energies of interest in fusion work, magnetic dissociation is equivalent to electrostatic dissociation where the equivalent field is E = vB. The range of parameters of interest in thermonuclear research corresponds to effective electric fields up to the order 10^6 V/cm. The threshold fields for dissociating the successive vibrational levels of all isotopic mixtures of the hydrogen molecular ion, H_2^+, HD^+, HT^+, D_2^+, DT^+, T_2^+, are reported. For the uppermost levels of these (nonrotating) ions the threshold fields range from 0.6×10^5 to 0.9×10^5 V/cm. Rotational effects are discussed in detail. The presence of rotation J introduces J + 1 new thresholds for a particular vibrational level; these thresholds are distributed about the single threshold for the nonrotating ion. The lack of a stepwise dissociation observed in the Riviere-Sweetman experiment can be interpreted as due to a superposition of contributions from rotational states up to J = 4, 5. Methods are discussed for enhancing the populations of the upper-most vibrational levels of the hydrogenic ions. The bound vibrational state belonging to the antibonding electronic state of each of the H_2^+, D_2^+, and T_2^+ ions can be dissociated with fields of the order 10^4 V/cm; reactions populating these levels are discussed. The formation of neutral hydrogen or deuterium atom beams by the charge exchange reaction provides a population distribution covering all excited states. The equilibrium populations of the excited levels are sufficiently large that the ionization by the Lorentz force competes favorably with the other ionization processes. A 30-kev H atom moving in a 60 kG field is susceptible to ionization down to the n = 8, 9 levels; a 100-kev atom in the n = 6 level is ionized by a 130-kG field. Containment experiments designed on the basis of these data are discussed. (auth)

9714 COUPLING BETWEEN ELECTROMAGNETIC AND ELECTRON WAVES IN A PLASMA. W. P. Allis (Massachusetts Inst. of Tech., Cambridge) and S. J. Buchsbaum. Nucl. Fusion, 2: 49-53(Sept. 1962). (In English)

The coupling between electromagnetic and electron plasma waves in a uniform plasma in the presence of a static magnetic field is studied. The transport equations are used to represent the plasma and Maxwell's equations to represent the fields. These yield a dispersion relation which is discussed here only for ions of infinite mass. Eight topologically different phase velocity surfaces suffice to represent the system of combined electromagnetic and electron waves for all values of plasma density and magnetic field strength. The plasma waves have cutoffs (phase velocity infinite) wherever the electromagnetic wave has a resonance (phase velocity zero); the coupling between the two waves is strong there and their respective velocity surfaces join smoothly one onto the other. Elsewhere the waves are distinct. (auth)

9715 INVESTIGATION OF A STATIONARY PLASMA IN A MAGNETIC FIELD. F. Boeschoten and F. Schwirzke (Institut für Plasmaphysik G.m.b.H., Munich). Nucl. Fusion, 2: 54-65(Sept. 1962). (In English)

A plasma is studied in an experimental arrangement called CABINET, which consists of a duoplasmatron as plasma source at one end and a 8000 litre/sec diffusion pump at the other end of a glass cylinder surrounded by magnetic field coils. The plasma drifts continuously along the axis into a magnetic bottle, the maximum magnetic induction in the center being 4000 gauss. The plasma (mainly hydrogen) was studied in two pressure ranges. In the first pressure range, $p = 10^{-5}$ torr ($L \ll \lambda_i$) and $T_e \simeq 12$ ev, $T_i \sim 10$ ev, n_e (at center) up to 2×10^{10} cm^{-3}. Large radial electric fields are present, varying from ~−100 v/cm (at r = 1 cm) to +10 v/cm (at r = 3 cm). Azimuthal currents are detected in agreement with the relation $j \times B = \nabla p$. In the second pressure range, $p = 10^{-3}$ torr ($L \gg \lambda_i$) and $T_e \simeq 1$ ev, $T_i \sim 0.1$ ev, n_e (at center) possibly up to 5×10^{13} cm^{-3}. The radial electric fields are one order of magnitude smaller than at 10^{-5} torr. The plasma density was derived mainly from electron and ion currents to a Langmuir probe, but the high densities in the center were also derived using microwaves and spectroscopy. In both pressure ranges the ion density decreases exponentially with radius between 1 cm and 4 cm from the axis, with an e-folding length depending as B^{-1} on the magnetic induction. Then a "kink" occurs; this kink moves closer to the axis with increasing magnetic induction. A critical discussion is given concerning determination of the perpendicular diffusion coefficient from measurements of the radial distribution of ions. (auth)

9716 QUANTUM THEORY OF THE ČERENKOV RADIATION IN PLASMAS. Taro Kihara (Tokyo Univ.), Osamu Aono, and Taro Dodo. Nucl. Fusion, 2: 66-9(Sept. 1962). (In English)

Quantum electrodynamics for anisotropic dispersive media has been developed and applied to the Cherenkov radiation from a fast moving charge in a magnetoplasma. The radiation loss caused by first-order transitions agrees with the classical result obtained from the work done by the charge, the final expression containing no Planck's constant. (auth)

9717 ON THE RADIAL CONTRACTION OF PLASMA IN AN AZIMUTHAL PINCH. Taijiro Uchida, Masatomo Sato, and Shigeo Hamada (Nihon Univ., Tokyo). Nucl. Fusion, 2: 70-7(Sept. 1962). (In English)

The contraction process of an azimuthal pinch was investigated with low $\dot{B}$ values (up to about 10^9 G/sec), where $\dot{B}$ is the rate of increase of the external magnetic field. Measurements of the primary current and voltage were used to obtain the inductance radius of the plasma column and the result was compared with high-speed photographs. An outer magnetic probe was used to deduce the internal magnetic field trapped in the plasma. The absence of instabilities during the contraction stage is a remarkable result of our experiment. An attempt was made to interpret this as due to the low values of $\dot{B}$. The assumption of infinite conductivity in computing the dynamics of contraction is found to be valid, and qualitative agreement with the snow-plow model is satisfactory. (auth)

9718 INVESTIGATION OF THE CONFIGURATION OF STRONG-POINT DISCHARGE IN WEAK STABLE AND ALTERNATING EXTERNAL MAGNETIC FIELDS. A. P. Babishev, A. I. Karchevskii, Yu. A. Muromkin, and V. V. Sokol'skii (Kurchatov Inst. of Nuclear Energy, Academy of Sciences, USSR). Nucl. Fusion, 2: 84-91(Sept. 1962). (In Russian)

An investigation has been made of the configuration of a discharge in a toroidal apparatus with magnetic flux conservation in the magnetic chamber section, with constant magnetic intensity in the periphery of the discharge and under conditions of an alternating external magnetic field. It is shown that in these cases the behavior of the discharge can be described on the basis of the quasi-stationary forceless model. (auth)

9719 AN INVESTIGATION OF THE THETA PINCH USING MAGNETIC PICK-UP LOOPS. T. S. Green (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nucl. Fusion, 2: 92-101(Sept. 1962). (In English)

An account is presented of the investigation of the behavior of the plasma in a theta-pinch device using a magnetic pick-up loop system. The technique has been developed to determine the current in the plasma from measurements made outside the plasma. Experimental results are presented to show the extent to which this determination contributes to an understanding of the phenomena of magnetic field trapping, radial, and axial motion and containment which occur in the Thetatron. Specific measurements can be made of the strength of trapped field when it is reversed. Observations can also be made of the variation of the plasma line density with time, and this has enabled a study of axial contraction and expansion to be made. It is found that the rate of axial contraction decreases as the strength of the reversed trapped field decreases. Near the transition region between the trapping of reversed and like magnetic field the line density is observed to be constant in time suggesting good containment. (auth)

9720 EXPERIMENTAL INVESTIGATIONS OF RUN-AWAY ELECTRONS IN A HYDROGEN PLASMA. U. Grossmann-Doerth and J. Junker (Max-Planck-Institut für Physik und Astrophysik, Munich). Nucl. Fusion, 2: 102-4(Sept. 1962). (In English)

The influence of a predischarge and of plasma contaminations on the run-away electrons in a toroidal discharge has been investigated experimentally. It was found that impurity ions in the plasma are of no importance. A predischarge reduces drastically the rate of run-away. This is probably due to the initial degree of ionization being larger than 1%. (auth)

9721 A PHYSICAL DERIVATION OF LANDAU DAMPING. F. A. Haas (Culham Lab., Abingdon, Berks, Eng.). Nucl. Fusion, 2: 105-6(Sept. 1962). (In English)

While a mathematically rigorous derivation of Landau damping has been given by Jackson (J. Nuclear Energy C1: 171(1960)), there is still some obscurity as to the underlying physical ideas involved. It is pointed out that the correct expression for Landau damping may be obtained physically by a method which is considerably simpler than that given by Dawson (Phys. Fluids 4: 869(1961)). (W.D.M.)

9722 INFLUENCE OF PLASMA VISCOSITY IN MAGNETIC FIELD ON STABILITY OF PLASMA. L. I. Rudakov (Kurchatov Inst. of Nuclear Energy, Academy of Sciences, USSR). Nucl. Fusion, 2: 107-8(Sept. 1962). (In Russian)

The influence of plasma viscosity on the stability of plasma is analyzed for the case of a heterogeneous plasma in a magnetic field H_0 with the gravity g, where $g \cdot H = 0$ in relation to channel two-dimensional flow perturbations and plasma pressure $p_0 = n_0 T_0$ is small in comparison to magnetic pressure $H_0^2/8\pi$. It is shown that the results presented by M. Rosenbluth et al. (Conference on Plasma Physics and Thermonuclear Synthesis, Zaltzburg, 1961, ref. 70) are found in precise plasma motion hydrodynamic equations. (R.V.J.)

9723 ON THE STRUCTURE OF HYDROMAGNETIC SHOCK WAVES WITH TRANSVERSE FIELD AND VISCOUS DISSIPATION. W. Geiger, H. J. Kaeppeler, and B. Mayser (Technische Hochschule, Stuttgart). Nucl. Fusion, Suppl., 403-10(1962). (In English)

The problem of hydromagnetic shock waves has recently received increasing interest in connection with experiments carried out to obtain extremely high temperatures for fusion processes. In such experiments a tendency toward appreciable densities (obtained, e.g., by magnetic compression) becomes noticeable. Theories of hydromagnetic shock structure available at present either neglect the inertial term in the differential equation for the magnetic field if dissipation processes are considered, or if the rigorous equations for the magnetic field are used, a collision-free plasma is considered. This paper deals with a study of the effect of viscous dissipation in the rigorous hydromagnetic shock structure equations for the purpose of deriving a theory applicable to relatively high densities. First, the shock structure for a pure hydromagnetic case (neglecting viscosity but considering ohmic resistance as a damping mechanism) is considered in some detail. A stability investigations is carried out and it is shown that there exist two regimes for the shock transition, one characterized by an oscillatory transition, the other by an aperiodic damped transition. Considering viscosity, the range for which this dissipation mechanism becomes appreciable is determined. It can furthermore be shown that whereas solutions for Mach numbers $M < 1$ behind the shock do not exist for the collision-free hydromagnetic case, the inclusion of viscous dissipation in the Navier-Stokes approximation indicates the possibility for such solutions. (auth)

9724 THE THEORY OF ADIABATIC WAVES ASSOCIATED WITH NON-DIAGONAL TERMS FOR THE PRESSURE TENSOR IN PLASMAS. J. L. Delcroix, J. F. Denisse, and D. Quémada (Laboratoire de Physique des Plasmas, Orsay, France). Nucl. Fusion, Suppl., 411-22 (1962). (In French)

The hydromatic theory of the propagation of plane monochromatic waves in an infinite homogeneous plasma in an arbitrary uniform magnetic field is developed in the general case with the aid of macroscopic equations, on the assumption that the changes produced by the waves satisfy certain adiabatic conditions: $\nabla p_\alpha = \gamma k T_\alpha \nabla n_\alpha$ (α = e, i); but this means that the pressure remains isotropic during the passage of the wave, though it is known that this hypothesis is certainly not verified for a plasma in an arbitrary magnetic field. A theory is proposed in which the pressure variation accompanying the passage of the wave is represented by a tensor without any restrictive hypothesis. The system of macroscopic equations is now completed by the condition $\nabla \cdot Q = 0$, which means that the heat flux is zero and must therefore be considered as a more general adiabatic condition. This new theory leads to results whose general characteristics agree very well with those obtained by the theory outlined in the first paragraph, particularly as regards the conditions of existence of pure transverse or pure longitudinal modes; in addition to the modes described in the first theory, however, the non-diagonal terms of the pressure-tensor bring in new modes. Their physical significance remains to be discussed, but the present theory at least permits definition of a limit of the domain of validity of the scalar pressure theory. Closer study has been given to the purely longitudinal modes, and to the purely transverse modes propagating longitudinally. (auth)

9725 LAGRANGIAN FORMULATION OF THE MAGNETOHYDRODYNAMIC EQUATIONS APPLIED TO STABILITY STUDIES. M. Cotsaftis (Euratom-CEA, Fontenay-aux-Roses, France). Nucl. Fusion, Suppl., 447-50(1962). (In French)

In the classical and Chew-Goldberger-Low magneto-hydrodynamic approximations, all the quantities—pressure, density, and magnetic field—are related to the fluid motion by equations of the type $dA/dt = 0$. In the Lagrangian representation these can be integrated, at least in principle. This circumstance is used to construct a Lagrangian, from which the equation of motion of the fluid is deduced by variation. The remaining quantities are then known by integrating the equation $dA/dt = 0$. From this Lagrangian, the equations for small movements around an arbitrary displacement, in the most general case, can be obtained very simply. It is remarkable that these equations are formally identical with those given by Hain, Lüst, and Schlüter for the particular case of small displacements around a position of static equilibrium; the quantities p, B, q, J are linked by various relations. The energy principle of Bernstein and others in the particular case of static equilibrium and its extension to the case of small velocities, and the sufficient conditions of Frieman and Rottenberg in the case of arbitrary stationary velocities are found. A particular class of motions is studied for which there exists a necessary and sufficient energy principle. (auth)

9726 QUASI-LINEAR THEORY OF PLASMA OSCILLATIONS. A. A. Vedenov, E. P. Velikhov, and R. Z. Sagdeev (Kurchatov Inst. of Atomic Energy, Moscow). Nucl. Fusion, Suppl., 465-75(1962). (In Russian)

A method of research is being developed concerning non-equilibrium processes in systems with collective degrees of freedom. This method allows states of non-equilibrium, with strongly excited (suprathermal) oscillations, to be studied. As applied to plasma, this method is as follows: when the non-equilibrium processes are examined, allowance is made for the influence of a self-consistent oscillatory field on the particle distribution function. The distribution function appears as a sum of slowly and rapidly varying terms. In the equation for the "slow" distribution function f_0, the quadratic mean effect of the oscillations is taken into consideration. In order to describe the oscillations themselves, the normal linear theory is adopted, but the average distribution function f_0 can be used as the background on which the oscillations take place. The quasi-linear method is used for the study of the problem of energy absorption of waves of finite amplitude in rarefied plasma. It is shown that, for suprathermal oscillations, damping is considerably less than that obtained from the normal linear theory, the magnitudes of the damping decrement being in inverse proportion to the energy density ϵ of the waves. The expression for the decrement of damping γ, valid for the field $\epsilon \ll kT$, takes the form $\gamma = \gamma_0/[1 + A\,\epsilon/kT)N_D]$ where $A \sim 1$, N_D is the number of particles in a sphere with the radius equal to the Debye radius and γ_0 is the decrement obtained in the linear theory. This formula for damping is applicable only in cases where the wave-packet is of sufficient "breadth:" $\Delta v_\varphi > (e\,\varphi_0/m)^{1/2}$ (where Δv_φ is the spread of phase velocities in the packet, and φ_0 is the amplitude of the potential). In the contrary limiting case of a monochromatic wave the "damping decrement" depends upon an amplitude such as $\epsilon^{-1/2}$. Such dependence occurs, for instance, during the damping of oscillations within a shock-wave front in rarefied plasma without any magnetic field. The results obtained are discussed in connection with diagnostic problems and in connection with the problem of high-frequency heating of a plasma. Oscillation processes are investigated in unstable plasma, not too far removed from the boundary of instability. An example is the stationary noise spectrum in plasma through which an electric current flows under conditions where ion electrostatic instability occurs.

The amplitude of the stationary oscillations has been determined. In cases where the plasma is in a strong magnetic field and the current travels along that field, the form of the oscillation spectrum is given by the expression $\epsilon_k \sim x^3(1-x^2)^{\frac{1}{2}}$ where $x = \omega_k/ks$, and $s^2 = T_e/m$. The limits of application of the quasi-linear theory just developed, the non-linear effects of wave-interaction and the question of transition to "turbulent" conditions are discussed. (auth)

9727 STOCHASTIC METHODS IN THE THEORY OF PLASMA DIFFUSION. J. B. Taylor (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nucl. Fusion, Suppl., 477-80(1962). (In English)

Although the theory of diffusion is fairly complete for thermal plasma (i.e., plasma in local thermodynamic equilibrium), there is almost no information on non-thermal plasma and it may well be that the conventional transport equation approach is not suited to a discussion of this problem. An alternative approach utilizing the correlation function of the fluctuating electric field in the plasma as its starting point has therefore been examined. In the first application of this approach, to thermal plasma, Nyquist's theorem played a central role. In discussing non-thermal plasma Nyquist's theorem cannot be used but instead one can employ equations of motion of the Langevin type. In the present paper the application, and the limitations, of this approach are discussed; it is shown that the diffusion of ions across a magnetic field can be derived simply in terms of the effective dynamic friction coefficient and the significance of this result is discussed. In particular it appears that for given plasma pressure there is a maximum value for the diffusion, related to the controversial "Bohm" diffusion. Comparison of this result with recent measurements on the Stellarator indicates that the maximum is attained in the turbulent plasma resulting from ion-wave instability. (auth)

9728 MICROSCOPIC INSTABILITIES OF SPATIALLY INHOMOGENEOUS PLASMA IN A MAGNETIC FIELD. L. I. Rudakov and R. Z. Sagdeev (Kurchatov Inst. of Atomic Energy, Moscow). Nucl. Fusion, Suppl., 481-6(1962). (In Russian)

The theory of the stability of rarified plasma in a magnetic field is generally based upon equations of magnetohydrodynamics with infinite conductivity. This approach, however, is lacking in completeness. Kinetic examination of the stability of rarefied plasma was carried out using the most simple magnetic field geometries, and it was shown that instabilities, not described by the equations of magnetohydrodynamics with infinite conductivity, may exist in plasma. Such instabilities may exist when the distribution function of the plasma particles differs from that for Maxwellian thermal equilibrium, as for instance in spatially inhomogeneous plasma, in which the density n and the pressure p are variable in space. Although in equilibrium the plasma as a whole is at rest, in an inhomogeneous magnetic field the electrons and ions of the plasma will drift across the lines of force of the magnetic field. Interacting with the perturbations, the particles, which drift in an inhomogeneous magnetic field, may transfer their energy to the perturbations, and build up electromagnetic waves in the plasma. The particles whose drift-velocity v_d is closest to the phase velocity of the wave interact most strongly with it. For such "resonance" particles, the electric and magnetic field of the wave is almost stationary. The motion of resonance particles in the wave-field, in the direction of the gradient of the non-perturbed distribution-function f and of the magnetic field leads to a transfer of energy. If $\nabla H \cdot \nabla(f/H)v_d = \omega/k > 0$, then particles on the average give up to the wave part of their energy, which has been stored in thermal motion and in the magnetic field. The time taken for the development of this instability however, is very great. The instability of spatially inhomogeneous plasma may develop much more quickly, owing to the transfer of heat in the inhomogeneously-warmed plasma as ion-acoustic oscillations propagate in it. The motion of particles across the magnetic field H_0 in an ion-acoustic wave which is propagating at an angle to H_0 and at a velocity $c\,E \times H_0/H_0^2$ in inhomogeneously-warmed plasma, leads to directional transfer of heat. The direction of propagation of the wave may be so selected that in the "bunching" phase of the plasma in the wave, where the temperature T is increasing, a flow of heat continually enters from the region with a higher unperturbed temperature. This leads to the build-up of ion-acoustic oscillations if $\partial(\ln T)/\partial(\ln n) > 2$ or $\partial(\ln T)/\partial(\ln n) < 0$. (auth)

9729 A KINETIC EQUATION FOR SPATIALLY INHOMOGENEOUS SYSTEMS WITH WEAK COUPLING. Edward Frieman (Princeton Univ., N. J.). Nucl. Fusion, Suppl., 487-9(1962). (MATT-82). (In English)

Prigogine and Balescu recently presented a derivation of the kinetic equation considered here using a diagram technique and operating directly on the Liouville equation. A derivation, similar to Rostoker's, of the same equation which eliminates the need for the diagram technique is presented. The derivation holds for spatially inhomogeneous systems with arbitrary interparticle potentials which satisfy the condition that the maximum value of the potential is small compared to the mean particle thermal energy. Three physically distinct time scales are present in such systems. In increasing order of magnitude they are: τ_1, duration of a collision, τ_2, the time between collisions, and τ_3, the time for a thermal particle to cross the spatial inhomogeneity. It is demonstrated that the two-particle distribution function f_2, phase mixes in a time t which satisfies the inequality $\tau_2 \gg t \gg \tau_1$. The phase-mixed value of f_2, when inserted in the collision term in the equation determining the rate of change of the one-particle distribution function f_1, yields the standard Fokker-Planck equation. In principle, the advantage of this derivation is that the "Stosszahlansatz" is demonstrated rather than assumed as in the work of Bogoliubov where f_2 is taken to be a functional of f_1. Similar results have been obtained for short-range forces. (auth)

9730 STUDIES OF STABILITY AND HEATING IN THE SCYLLA MAGNETIC COMPRESSION EXPERIMENT. E. M. Little, W. E. Quinn, F. L. Ribe, and G. A. Sawyer (Los Alamos Scientific Lab., N. Mex.). Nucl. Fusion, Suppl., 497-509(1962). (TID-13890). (In English)

The Scylla experiment has been extended to higher capacitor bank energies ($31\ \text{kJ} \leq W \leq 180\ \text{kJ}$) and applied magnetic fields ($44\ \text{kG} \leq B_m \leq 145\ \text{kG}$). Various coil lengths ($10.6\ \text{cm} \leq l \leq 26.8\ \text{cm}$) are also used. The stability of the plasma in its compressed state is studied by means of streak and Kerr-cell photographs. Depending upon the values of W and l, the plasma is found to: (a) remain stable throughout the compression; (b) show a growing instability in the form of a rotating elliptical structure; or (c) show a violent instability after an initial period of stability. For small W and large l the plasma is stable; as W is increased or l is decreased, it becomes progressively unstable. The rotating structure appears to correspond to a growing $m = 2$ Rayleigh-Taylor flute disturbance, with superimposed rotation of the plasma as a whole. The rate of flute growth is smaller by an order of magnitude than that calculated from the bending of the magnetic mirror lines, and the parameters of the experiment suggest that the stabiliz-

ing effects of finite Larmor radii predicted by Rosenbluth, et al., may occur. Electron temperatures T_e are determined by measuring the shape of the soft x-ray continuum with a crystal spectrometer and also with thin absorbers. T_e scales with magnetic field approximately as $B_m^{4/3}$ as would be expected from a model of shock heating followed by adiabatic compression at $\gamma = 5/3$. Time histories of T_e and B during individual compressions show regular behavior of T_e for the stable or weakly unstable cases. The observed slope of ln T_e versus ln B during decompression is smaller than $4/3$, corresponding formally to $\gamma \approx 4/3$. For cases with well-developed instability, T_e shows an abrupt decrease at the onset of the instability. There is also an analogous sudden discontinuity in the time distribution of neutron emission when the instability begins. Neutron scaling results show a somewhat slower rise of emission rate R_n versus B_m than would correspond to a two-stage model with adiabatic compression. The scaling curves of T_e and R_n show abrupt decreases for $B_m > 100$ kG which correlates with a large observed increase of soft x-radiation. Large variations of R_n are coupled with much smaller variations of T_e. This tends to confirm an earlier observation in Scylla I that the ions and electrons are to some extent energized independently and that the trapped reversed field exerts a larger effect on the ions. (auth)

9731 RAPID AXIAL CONTRACTION OF A HIGH DENSITY DEUTERIUM PLASMA IN A THETATRON DISCHARGE. H. A. B. Bodin, T. S. Green, G. B. F. Niblett, N. J. Peacock, J. M. P. Quinn, J. A. Reynolds, and J. B. Taylor (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nucl. Fusion, Suppl., 511-20 (1962). (In English)

Experimental observations are presented of the axial contraction of a dense deuterium plasma during the second half-cycle of a high current magnetic compression experiment in which reversed trapped field is left over from the first half-cycle. The reversed field configuration produces a rapid axial contraction and subsequent expansion of the plasma column during which energy in the trapped magnetic field is dissipated. High speed streak and framing cameras and external flux coils are used to monitor the profile of the plasma and to measure the axial velocity of the change in cross-sectional plasma area. Peak axial velocities of 1.2×10^7 cm/sec are recorded. Measurement of the velocity and area ratio of the propagating discontinuity provides a method of determining the ion temperature ahead of and behind the area change. A theoretical appendix analyses the propagation characteristics of area waves and area shocks and presents solutions of the appropriate conservation equations. (auth)

9732 THE INFLUENCE OF TRAPPED FIELD ON THE CHARACTERISTICS OF A MAGNETICALLY COMPRESSED PLASMA (THETATRON). H. A. B. Bodin, T. S. Green, G. B. F. Niblett, N. J. Peacock, J. M. P. Quinn, and J. A. Reynolds (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nucl. Fusion, Suppl., 521-32(1962). (In English)

Recent results of an experimental investigation of deuterium plasma compressed by a rapidly rising magnetic field are presented and discussed. The discharge which occurred on the second half-cycle of a sinusoidal driving field without preionization was studied and it was found that in the pressure region 50 to 95 μ Hg the trapped flux varied in the range ± 25 kilomaxwells. Thus careful control of the initial pressure provided a simple way of varying the trapped flux. In this pressure range the characteristics of the discharge were observed to change markedly, and it is shown that the properties of the plasma are primarily determined by the trapped flux. Three types of discharge are analyzed in detail. The first type, trapping maximum parallel flux, has a low β and a low temperature; it is well contained and emits neither neutrons nor soft x-rays although hard x-rays are observed. The second type traps much less parallel flux, has β between 0.2 and 0.8, emits no neutrons and only very small yields of x-rays, and escapes rapidly. The third type traps maximum reversed flux, which is subsequently destroyed. The implosion velocity increases with pressure and the neutron and soft x-ray intensities peak sharply at the pressure at which the trapped reversed field energy and the total energy (field and particle) are a maximum. Soft x-ray measurements lead to an electron temperature between 180 and 400 ev, and total energy measurements show that sufficient energy is available to raise the ions to a temperature of 1 kev. The plasma forms an unstable closed field loop configuration, contracts axially and remains contained away from the walls for about 2.5 μs, after which it normally breaks up following a rapid rotation. (auth)

9733 SOME NEW DATA ON SELF-COMPRESSED DISCHARGES. I. F. Kvartskhava, K. N. Kervalidze, Yu. C. Gvaladze, and B. N. Kapanadze (Inst. of Physics and Tech., Academy of Sciences, Georgian SSR). Nucl. Fusion, Suppl., 533-42(1962). (In Russian)

The theory of self-constricted discharges, which predicts the possibility of the appearance of various types of instabilities, does not reflect fully the multiple phenomena which are experimentally observed. The models used in the theory evidently do not consider the presence of some processes in self-constricted discharges which materially determine the real behavior of the plasma. The experiments showed a number of such processes. Basically, they consist of an unequal heating of the discharge near the walls of the chamber. Thereby the discharge currents flow along distorted threadlike channels which, in θ-pinches mostly follow either the z-direction or the θ-direction, and in z-pinches they basically follow the θ-direction. In the process of plasma compression the above mentioned thread formations experience unequal accelerations. Having a high conductivity, these formations facilitate the capture of magnetic fields which obstructs the thermalization of the kinetic energy of the plasma's radial motion. As a result of this process the plasma is far from thermal equilibrium when in the stage of maximum compression. It is encompassed by a motion of turbulent character. After the maximum compression of the plasma, various kinds of plasma formation are ejected from the surface of the pinch. The magnetic field is more effectively trapped than in z-pinches. Consequently, a greater variety of types of instability is observed in θ-pinches than in z-pinches. High-speed photography of the discharge turned out to be the most practical and fruitful method of studying the processes of formation and the subsequent motion of the plasma. Photographs of the discharges obtained by streak photography and by framing camera are discussed. The results of probe measurements of magnetic and electric fields as well as the results of measurements of currents by means of Rogovsky belts are given. (auth)

9734 MEASUREMENTS OF ELECTRON DENSITIES AND TEMPERATURES AND OTHER PLASMA PARAMETERS IN MAGNETIC COMPRESSION EXPERIMENTS. H. R. Griem, A. C. Kolb, W. H. Lupton, and D. T. Phillips (Naval Research Lab., Washington, D. C.). Nucl. Fusion, Suppl., 543-51(1962). (In English)

A high energy plasma is produced in preionized deuterium (0.1 mm Hg) that has been preheated with an electrodeless discharge to 1.0 ev by a current pulse through a

single-turn coil (length 70 cm, inner diameter 5.7 cm, mirror ratio 2:1, peak current 5.5 MA, H_{max} 80 kG in 5 μs, coil voltage 9 kV, bank voltage 17 kV). Time-resolved measurements of the soft x-ray intensities transmitted by various absorber foils yield an electron temperature which rises rapidly from 1 kev at 3 μs to 2.5 kev at peak current and persists at this level through most of the first half-cycle. This electron temperature is higher than the temperature expected from shock heating and adiabatic compression by a factor of ~3 to 6. The additional heating is due to the dissipation of an initially trapped reverse field of 6 kG opposite in direction to the main confining field. From the visible bremsstrahlung follows an electron density of $7 \pm 2 \times 10^{16}$ cm^{-3} at the time of maximum current, indicating a high β. Streak camera observations show that the plasma is macroscopically stable through most of the first half-cycle of the discharge and that end losses are small. Towards the end of the first half-cycle, the plasma splits into two filaments rotating around each other, and the end losses increase sharply. For the first 2 μs the radial electron density distribution has a minimum on the axis, due to some remaining trapped (reserve) field. The upper limit for impurities during the first half-cycle is about 1% since within the experimental error no excessive x-ray radiation could be observed, and otherwise rapid radiation cooling would dominate the electron temperature. (During the second half-cycle the electron temperature stays below 300 ev.) Similar experiments (PHAROS) with a larger plasma volume (length 180 cm, bore 9.6 cm, mirror ratio 2:1) and comparable fields (80 kG at 11.5 MA in 10 μs) yield electron temperatures of 350 ± 50 ev, which is lower than before, possibly because of the longer times required for the reverse field to dissipate with a larger plasma diameter. However, the impurity concentration is not yet known and this could account for the difference. (auth)

9735 A HIGH ENERGY MAGNETIC COMPRESSION EXPERIMENT. A. C. Kolb, H. R. Griem, W. H. Lupton, D. T. Phillips, S. A. Ramsden, E. A. McLean, W. R. Faust, and M. Swartz (Naval Research Lab., Washington, D. C.). Nucl. Fusion, Suppl., 553-9(1962). (In English)

To investigate the production of large volumes (~500 cm^3) of collision-dominated plasma at densities of ~10^{17} cm^{-3} with temperatures in the kilovolt range, a large 2 MJ, 20 kv capacitor bank with 2.5 m μH external inductance was put into operation in April 1961. The entire system, PHAROS, can produce 20 MA in a 13 liter single turn coil, 180 cm long with a 10.5 cm bore and 2:1 mirror ratio (inductance 5.4 m μH) corresponding to peak fields ~150 kG in ~14 μs. Initial experiments are reported with 11 MA and 80 kG using 714 kJ for an initial pressure of 100 microns Hg D_2. The heating is accomplished by a sequence of RF; joule heating to ~1.2 ev ($N_e = 10^{16}$ cm^{-3}, 50 to 95 percent ionization) by I_θ currents (250 kA); shock heating by the initial implosion when the main bank voltage is applied; dissipation of an initial trapped reverse field which is between 0 to 10 kG (3.8 kG at present) initially (generated by a 190 kJ slow capacitor bank); and finally slow adiabatic compression by the rising field of the large bank. An important feature of magnetic compression experiments is the onset of an instability (observed in smaller coils). This is caused by plasma rotation at high compression ratios, which seems to be caused by the relaxation of the reverse field. This instability has not yet been observed in PHAROS, probably because of the relatively long characteristic time for the reverse field relaxation with a plasma diameter of 1.7 cm. Evidence is presented (for 1/9 of the PHAROS bank) which indicates that end losses are small; reverse field relaxation is not complete; the effective β is high with $N_e = 4 \pm 1.5 \times 10^{17}$ (from the visible continuum) and $T_e = 350 \pm 50$ ev. Under these conditions the mean-free-paths are small (≤ 1 cm) so that the plasma pressure should be isotropic and a hydromagnetic description may be expected to have some validity. The total number of confined particles is 10^{20} with a volume compression of 30. (auth)

9736 FAST THETA-PINCH. K. Hain (Institut für Plasmaphysik, Garching, Ger.) and A. C. Kolb. Nucl. Fusion, Suppl., 561-9(1962). (In English)

A fully ionized plasma with cylindrical symmetry is assumed. The hydromagnetic theory should be valid, that is, the two-fluid model with charge neutrality including electrical resistivity and thermal conductivity. The ion and electron temperatures are treated separately. As an initial condition a fully ionized homogeneous plasma with magnetic fields is assumed. To this plasma B_z-fields are applied. The resulting partial differential equations are solved numerically. The effects of different initial B_z-fields—parallel, zero, reversed—are discussed. In all cases there are types of shock waves running into the undisturbed plasma. With parallel fields a simple consideration shows that the Mach-number has to exceed 3/2 to get an ion temperature higher than electron temperature. In the zero field case, because of high thermal conductivity in absence of magnetic fields, a heat wave of electrons runs in front of the shock front. The reversed field case shows the highest ion temperature. (auth)

9737 A COMPARISON BETWEEN NUMERICAL CALCULATIONS OF A LINEAR z-PINCH DISCHARGE AND MEASUREMENTS BY MAGNETIC PROBES. H. Fisser (Max-Planck-Institut für Physik und Astrophysik, Munich) and J. Schlueter. Nucl. Fusion, Suppl., 571-6(1962). (In English)

Distributions of the axial B_z (r,t) and the azimuthal B_θ (r,t) magnetic fields in an argon linear, stabilized z-pinch discharge, obtained from magnetic probe measurements, are compared with numerical calculations. Ionization of Ar II was taken into account and brought about an essential improvement in the B_θ distributions compared with calculations without Ar III production, so that there is now good agreement with the measurements. The results give rise to the hope that a more exact treatment of the motion of the Ar III particles will also improve the theoretical B_z distributions, since B_z is more affected by the dynamics of the discharge than B_θ. The consideration of Ar IV, observed in the discharge, and of excitation phenomena may remove the remaining deviations in B_θ from the measured values. It is concluded that z-pinch discharges with a ratio of about 1 cm/μs between tube radius and bounce time can be described accurately by the magnetohydrodynamic equations up to times shortly after the first compression. (auth)

9738 DENSE HIGH-TEMPERATURE PLASMA IN A NON-CYLINDRICAL Z-PINCH COMPRESSION. N. V. Filippov, T. I. Filippova, and V. P. Vinogradov. Nucl. Fusion, Suppl., 577-87(1962). (In Russian)

In previous investigations of strong pulse discharges in a chamber with metal walls it was found that the compression of the current sheath is not cylindrical but has its focus on the axis of the chamber near the anode; the focus serving as a sharply localized source of intensive neutron radiation. A peculiarity of the discharge is that a current sheath is formed in that gas which does not participate in the subsequent compression towards the axis. Primary attention has been given to investigating the qualities of the

plasma at the instant of maximum compression. Measurement of the pressure along the axis of the discharge was carried out with the help of a diaphragm meter. From the experiments it was found that the pinch effect leads to the formation of a constricted region having a diameter of about 0.5 cm and an average discharge density of about 10^{19} cm^{-3}. Due to the plasma accumulation within this region a zone of 1 to 1.5 mm diameter arises, having approximately the same density and a temperature of 0.8 to 1.2 kev. The observed lifetime (0.2×10^{-6} sec) of this zone considerably exceeds the time needed for the Maxwellization of the deuterons and for equalization of the electron and ion temperatures. Due to the large emission of protons in the D—D reaction it was possible for the first time to obtain the energy distribution of protons for one discharge. The maximum emission of neutrons which has been recorded is 0.5×10^{10}. The data obtained are in agreement with calculations made according to the theory of Braginski et al., taking into consideration the effect of shock wave accumulation in a region with dimensions of the order of the free path for the various parameters. (auth)

9739 PRODUCTION OF A HIGHLY IONIZED DEUTERIUM PLASMA, OF LOW IMPURITY LEVEL, WITH AND WITHOUT MAGNETIC BIAS FIELDS, FOR MAGNETIC COMPRESSION EXPERIMENTS. H. Beerwald, P. Bogen, T. El-Khalafawy, H. Fay, E. Hintz, and H. Kever (Institut für Plasmaphysik der Kernforschungsanlage, Julich, Ger.). Nucl. Fusion, Suppl., 595-9(1962). (In English)

Magnetic compression experiments require a well defined, highly ionized initial plasma. Otherwise main effects occur during the second compression half-cycle in a plasma of comparatively high impurity, and under rather uncontrolled conditions. Investigations have been made on the production of plasma by a pulsed, rapidly oscillating electrodeless ring discharge in RF-preionized gas, and within a straight magnetic compression coil. The amount of trapped internal magnetic field is controlled by an initial axial magnetic bias field. The breakdown mechanism can be theoretically and experimentally shown to depend on the direction and strength of the bias field with respect to the pulsed field, and the initial electron density. Ionization growth has been determined by microwave techniques. The results explain typical phenomena of non-preheated compression experiments. Full ionization in deuterium at electron temperatures around 2 ev is reached. It is observed that heating is due to interdiffusion of magnetic fields of opposite polarity. The plasma has very low impurity content and reaches both thermal equilibrium and a homogeneous density distribution at the end of the preheating pulse. Electron densities are measured by Stark broadening of H_β. The amplitude of trapped magnetic field can be varied from 0 to 3000 G. The measured field distribution is homogeneous at the end of the pulse. The method produces a fully ionized clean plasma with known and uniform initial parameters such as temperature, density, and internal magnetic field, which can be varied in a reproducible way. (auth)

9740 EFFECTS OF AMPLITUDE AND POLARITY OF INTERNAL MAGNETIC FIELD ON THE FAST MAGNETIC COMPRESSION OF A FULLY IONIZED, UNIFORM PLASMA. E. Hintz (Institut für Plasmaphysik der Kernforschungsanlage, Julich, Ger.). Nucl. Fusion, Suppl., 601-5(1962). (In English)

The time history of the fast magnetic compression of a plasma depends critically on the initial parameters. Of importance are density, conductivity, degree of ionization, and especially the strength and sign of the internal magnetic field. An experimental technique is described by which the production of a preheated plasma with controlled initial parameters is decoupled from the actual plasma compression. The experiments were made with a single-turn, cylindrical compression cell without mirrors, with a peak magnetic field of 50 kG and a quarter period of 1 μs. This method gives a full reproducibility of all measurable quantities during the stable phase of the magnetic compression. Unstable behavior is observed in later stages (near current maximum) in certain parameter ranges. In other ranges of values of density and internal magnetic field the compressed plasma is stable during the whole first half-cycle of the compression. Measurements with magnetic probes and smear camera pictures show that in the case of parallelled internal field up to 1000 G magnetic flux is conserved during compression and that the ratio β of kinetic pressure to external magnetic pressure is above 0.8. The line density of particles in the plasma volume is constant up to current maximum and equal to the initial value. After current maximum end-losses grow rapidly. The case of negligible internal field gives a $\beta \approx 1$ and a high compression of the plasma. The case of antiparallel internal field shows in contrast to the parallel configuration a very sharp defined transition zone between external and internal field. During compression this transition zone smears out gradually and disappears near current maximum. At the same time probe signals indicate the breakthrough of the external field, while smear pictures show no difference when the probe is inserted. (auth)

9741 THEORY OF DYNAMICAL BEHAVIOUR OF PLASMAS WITH INTERNAL MAGNETIC FIELDS DURING MAGNETIC COMPRESSION: COMPARISON WITH EXPERIMENTS. H. Kever (Institut für Plasmaphysik der Kernforschungsanlage, Julich, Ger.). Nucl. Fusion, Suppl., 613-16(1962). (In English)

Application of the free particle reflection model to the process of magnetic compression of axial-symmetric plasmas without internal magnetic fields gives analytical solutions for the time of maximum compression and for the energy gained by the plasma during the first compression period. More general results to the dynamics of plasma compression are obtained when internal magnetic fields are included. Two approximations to the magnetichydrodynamic equations are deduced and solved. In the first approximation the thickness of the shocked region is assumed to be small as compared to the plasma radius, leading to the Rosenbluth-Garwin snow-plow-equation with inclusion of trapped magnetic fields and finite kinetic pressure. Plasma radius, internal magnetic field, and the kinetic energy of plasma at maximum compression are calculated as functions of initially trapped magnetic field and ratio of coil inductivity to external inductivity. The results are compared with magnetic probe measurements and streak camera photographs of a fast magnetic compression experiment. In a second adiabatic approximation to the flow problem in magnetic compression experiments the magnetic flux inside the plasma is assumed to be constant and the magnetic field is assumed to be self-similar, as indicated by magnetic probe measurements. The resulting equation of motion and the equation for the current are solved numerically as a set of simultaneous equations, showing the effect of finite oscillation period of the external current on the plasma motion. Results are again compared with experimental observations by streak camera photographs. (auth)

9742 MEASUREMENTS ON AN ORTHOGONAL PINCH DISCHARGE. J. E. Allen, M. U. Martone, and S. E. Segre

(Euratom-C.N.E.N., Frascati, Italy). Nucl. Fusion, Suppl., 617-19(1962). (In English)

Measurements on an orthogonal pinch discharge are reported, the discharge being produced by a condenser bank of 11.25 μF at 20 kv with a period of oscillation of 35 μs. Above a certain pressure ($\sim$ 250 μ Hg in A) a converging shock is produced at each half cycle of the exciting current. Below this pressure the discharge has a complicated behavior; a luminous sheet is observed, which may be interpreted as an ionization wave, and a high-frequency oscillation of the magnetic field takes place. (auth)

9743 OBSERVATIONS OF AN ORTHOGONAL PINCH DISCHARGE (CARIDDI). J. E. Allen, C. Bartoli, B. Brunelli, J. A. Nation, B. Rumi, and R. Toschi (Euratom-C.N.E.N., Frascati, Rome, Italy). Nucl. Fusion, Suppl., 621-6(1962). (In English)

Observations are reported of an orthogonal pinch produced by means of a six-sector device. The discharge has been photographed using a rotating-mirror (streak) camera and also with an image converter. Measurements have been made of the coil current and of the voltage per turn, the latter being about 60 kv. Magnetic probe measurements have also been made and are compared with the optical data. (auth)

9744 END EFFECTS IN A LINEAR PINCHED DISCHARGE. A. Folkierski, P. G. Frayne, and R. Latham (Imperial Coll. of Science and Tech., London). Nucl. Fusion, Suppl., 627-33(1962). (In English)

Kerr-cell photographs of unstabilized linear pinched discharges in argon are presented. A detailed study of the onset of instabilities, the development of constrictions of the m = 0 (sausage) type, and the manner in which these lead to the final loss of containment, is made with the aid of the photographs. It is found that m = 0 constrictions occur in the vicinity of the electrodes during the expansion of the discharge after the first pinch. They lead to the formation of axially moving luminous fronts, which are probably shock waves. The region between the two fronts approaching one another collapses to a second pinch and expands again, losing confinement only when fronts advancing from m = 0 constrictions meet one another. In view of the effect of the fronts on containment, the nature and velocity of the fronts are studied as a function of discharge parameters — in particular voltage and pressure. (auth)

9745 ON THE MECHANISM OF THE HIGH-CURRENT GAS DISCHARGE IN A WEAK MAGNETIC FIELD. A. P. Babichev, A. I. Karchevski, Yu. A. Muromkin, and V. V. Sokolski. Nucl. Fusion, Suppl., 635-9(1962). (In Russian)

The configuration of magnetic fields in toroidal high current discharges was studied in the Zeta, Sceptre, Alpha, and other devices. We have performed analogous investigations, however, with a greater variety of external conditions. In one series of measurements the longitudinal magnetic flux was kept constant in the cross-section of the discharge chamber, in the second series the strength of the field at the end of the discharge chamber was kept constant, and in the third the external magnetic field was varied in the course of the discharge. It was found that all observed phenomena can be both qualitatively and quantitatively explained from one point of view. The experiments were carried out on a toroidal chamber having a thick aluminum sheath (10 mm) with diameters of 750 and 250 mm. A discharge chamber "liner" with a diameter of 160 mm was placed within the sheath. The discharge in hydrogen at a pressure of 10^{-3} to 5×10^{-4} mm Hg with a duration of 600 μs was investigated. It should be noted that in the first series of experiments the configuration of the discharge at a given magnetic flux in the liner cross-section is determined merely by the magnitude of the current flowing through the plasma at a given instant of time and is independent of the phase of the discharge in which this current is reached. In the second and third series of experiments, the configuration of the discharge is fully determined by the magnitudes of the current and of the external magnetic fields at the end of the discharge and does not depend on the rate of their variation. From this it follows that the diffusion time for the magnetic field in the plasma is short compared to the periods of variation of the external magnetic fields, i.e., the magnetic field is not frozen in the plasma. This is consistent with the low conductivity of the plasma and with its insignificant temperature. The observed phenomena are described by a quasi-stationary force-free model. The comparison of the results calculated according to this model yields good qualitative agreement for all three series of experiments. The absence of currents perpendicular to the direction of the magnetic field can, from a microscopic point of view, be explained within the framework of the convective instability mechanism. (auth)

9746 EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF THE CURRENT-ONSET IN LINEAR PULSE DISCHARGES. W. Frie and A. Michel (Siemens-Schuckert-Werke, A.G., Erlangen, Ger.). Nucl. Fusion, Suppl., 641-4(1962). (In English)

Probe measurements demonstrate the existence of a current channel near the axis immediately after the breakdown. This current is interpreted as a consequence of the transition from a glow discharge to an arc due to thermal instability. Theoretical considerations, using Maxwell's equations, the balance of energy and Ohm's law, deal with the variation of current density, electric field strength, and conductivity in space and time. Theoretical and experimental results are compared. (auth)

9747 RADIATION BY IMPURITIES IN RARIFIED HOT PLASMA. A. P. Vasilev, G. G. Dolgov-Savelev, and V. I. Kogan. Nucl. Fusion, Suppl., 655-61(1962). (In Russian)

Numerical calculations of the intensity of radiation by impurities of a number of elements in rarified hydrogen plasma in the range of temperatures from several ev to 10 kev have been carried out. The degree of ionization of the atoms of the impurities is determined starting from the stationary state of rarified plasma, which state is characterized by the equilibrium between the ionization by an electronic shock and the radiation recombination ("Elwert" equilibrium) for some of the elements considered. A separate calculation has been made of the contributions to the full radiation intensity due to the bound-bound, free-bound, and free-free transitions. The effective cross-sections of the excitation of the impurity ions are taken from the Born approximation or its semi-empirical modifications. The temperature curve for the intensity of the impurity radiation shows several maxima and minima (corresponding to the number of electron shells of the given element). In the largest of the maxima the intensity of radiation for one atom of the impurity exceeds by a factor of more than 10^5 the intensity of the radiation for one atom of hydrogen. Where possible, a comparison is made with the results of the computations carried out by Knorr and Post. In this connection a part of Knorr's results is criticized. The range of applicability of the results given here as well as the estimation equation given earlier are discussed. An estimate is given of the role played by impurity in transient

effects (the initial stage of the processes of finite duration) and in this connection some conclusions of McWhirter are discussed. The times for reaching ionization equilibrium are computed for various degrees of ionization, depending upon the temperature. The role of metastable states in the losses due to the radiation by the impurity is discussed. The results obtained are used for estimating the role of impurity radiation in the loss of energy from actual experimental systems. (auth)

9748 THE COLLISION OF TWO PLASMAS. John Marshall and T. F. Stratton (Los Alamos Scientific Lab., N. Mex.). Nucl. Fusion, Suppl., 663-74(1962). (TID-13892; LADC-4824). (In English)

Two coaxial guns inject hydrogen or deuterium plasmas into opposite ends of an evacuated drift space containing an axial magnetic field. With simultaneous firing of deuterium plasmas, the fast fronts of the plasmas ($\sim 10^8$ cm/s) superimpose to produce an extended region of plasma in which the transverse energy density is approximately 2 J per cm length, the transverse ion temperature is ~3 kev, and the particle density is $\sim 10^{14}/cm^3$. Following the fast plasma component, there is a slower component, observable by Coulomb scattering of the ions in one plasma by the ions in the other. The temperature is considerably smaller (~100 ev) than that of the fast component, but the density is high ($\sim 10^{16}/cm^3$) and the particles are presumably well randomized in direction. No evidence has been obtained for a two-stream instability in the plasma collision. Unexplained phenomena take place in the entry of the plasma into the guide field. The fast component appears to penetrate the magnetic field without regard to its strength, and the slow plasma component enters the field with practically no energy in the transverse degrees of freedom. (auth)

9749 ELECTRODELESS PLASMA GUN. F. Waelbroeck, C. Leloup, J. P. Poffé, P. Evrard, R. Der Agobian, and D. Véron (Euratom-CEA, Seine, France). Nucl. Fusion, Suppl., 675-85(1962). (In English)

The discharge of a condenser bank (< 3 kJ) into a single turn conical coil encircling a tube injects a deuterium plasma consisting of $< 10^{19}$ particles (ions + electrons) into a longitudinal magnetic guide field ($B_z < 4000$ G). For various experimental conditions, velocities in the range 3×10^6 to 3×10^7 cm/s have been observed. For most of the experiments described, the energy stored in the gun condenser bank was low (720 J); a set of experimental parameters were varied within rather broad limits. The only identified impurity lines in the visible spectrum are weak C-lines. The velocity and longitudinal shape of the plasma were measured by magnetic loops, microwave techniques, and photomultipliers, its momentum and radial distribution by ballistic pendula. The variation of the D_β line broadening as a function of time is being studied by means of a 10 channel (0.19 Å/channel) analyzer. For guide fields $B_z < 1000$ G, the collimation of the plasma beam appears satisfactory. The plasma puff is slowed down, and its luminosity enhanced, when the delay between the opening of the quick-acting valve (injecting the D_2) and the discharge of the gun is too long; a large number of neutral molecules is then on the beam trajectory. The effect of these neutrals increases when the guide field intensity decreases. The use of a crowbar on the discharge has confirmed the fact that little plasma is ejected during the first half-cycle of the discharge current (period = 6 μs). During the second half-cycle, the amount of plasma ejected is large when the gun and guide fields are parallel; when they are antiparallel, the amount of plasma ejected decreases as the guide field intensity increases. It is quite small for high guide field values. When the amount of D_2 introduced into the tube is small, the ejection occurs later: at the third, fourth or fifth half-cycle of the gun current. Small amplitude oscillations are usually detected on the magnetic loop signals. These frequencies are almost those of the ion cyclotron rotation in the guide field. An approximate model predicts satisfactorily the shapes and amplitudes of the four magnetic loop signals (oscillations expected) from hypotheses on the average ion and electron temperature, on the average velocity of the plasma, and on its initial shape. (auth)

9750 INTERACTION OF A PLASMA WITH AN ELECTROMAGNETIC FIELD IN A CAVITY RESONATOR. Yu. I. Arseniev, V. M. Glagolov, G. A. Eliseev, and N. S. Cheverev. Nucl. Fusion, Suppl., 687-91(1962). (In Russian)

In a vacuum cylindrical resonator, fed from a pulse magnetron (10 cm band), oscillations of the type H_{111} with a high-frequency magnetic field amplitude ~250 oersteds and a pulse duration of 1.2 μs were excited. Plasma, created by a high-frequency pulse source, was injected into the resonator. The density of the plasma exceeds 10^{12} cm^{-3}. The entire system was in a constant magnetic field ($H_0 \sim 1500$ oersteds). The interaction of the plasma with the electromagnetic field of the cavity resonator was studied. It was established that the electromagnetic wave pressure prevented the plasma from entering the resonator. The results are discussed. (auth)

9751 TRANSVERSE MOTION OF PLASMA IN MAGNETIC FIELDS. L. I. Elizarov and A. V. Zharinov (Kurchatov Inst. of Atomic Energy, Moscow). Nucl. Fusion, Suppl., 699-704(1962). (In Russian)

The influence of magnetic field strength on the probe-determined characteristics of a discharge with an incandescent cathode was studied. The probes were established in the anode plane outside the beam of primary electrons. It was found that the ratio I_e/I_i, of the saturation electron current to the ion saturation current, varies irregularly with the increase of the magnetic field. At a certain critical value of the field, I_e/I_i suddenly increases by approximately one order. The oscillograms of the probed characteristics showed that in the vicinity of the critical value of the magnetic field there arise in the discharge intensive oscillations with frequencies $\sim 10^4$ Hz which oscillations diminish both the electron and ion branch of the oscillograms. The critical magnetic field depends on the kind of gas (H_2, N_2, A) and increases approximately linearly with the pressure in an interval from 10^{-3} to 10^{-2} mm Hg. While studying the phase relations between the variable component currents in the probes, it was established that when there is a critical magnetic field, a stationary rotating plasma torch is formed which tears itself away from the primary beam. The plasma concentration in the torch is considerably greater than outside the torch. The period of rotation of the torch is in agreement with the drift velocity value and diminishes with increasing magnetic field in the interval from 100—30 μs at H = 1 to 3×10^3 oersteds, respectively. For the purpose of a more detailed and graphic study of the processes of creation and motion of plasma across a magnetic field, we have developed a device called a plasmascope. The plasmascope represents a plane electron-optical system consisting of two parallel fine grids and a luminous screen. The first grid of the plasmascope is the anode of the discharge. A non-transluscent aluminum film having a thickness of 200 to 500 millimicrons was placed on the luminous screen above the phosphor layer. The plasmascope can work in two conditions of operation. In the condition of "electron" image the second mesh has the anode

potential and is an electrostatic screen. The electrons from the plasma passing through both grids are accelerated in the gap between the second grid and the screen by a positive pulsed voltage and they cause the phosphor to glow. In the condition of "ion" image a negative pulse is placed on the second grid and the screen is at the anode potential. The glow of the phosphor is caused by the secondary electrons expelled by the ions from the second grid. The plasmascope works under conditions of regularly repeated pulses having a frequency of 0 to 50 Hz. A negative pulse with an amplitude from 0 to 500 v and with a duration from 10 to 100 μs is supplied to the cathode of the discharge. The brightening (intensity gate, bias lighting) pulse having an amplitude of 10 kv and a duration of 1 to 3 μs is supplied to the screen or to the second grid with a deliberately regulated delay after switching the discharge pulse. The polarity of the pulse varies, depending on the conditions of operation. Thus we observe the successive stages of development of the discharge and the successive stages of transverse motion of the plasma with a retardation of 10^6 or more. (auth)

9752 EXPERIMENTS ON THE ENERGY BALANCE AND CONFINEMENT OF A MAGNETIZED PLASMA. J. Bergstroem, S. Holmberg, and B. Lehnert (Royal Inst. of Tech., Stockholm). Nucl. Fusion, Suppl., 705-16(1962). (In English)

In order to achieve a fully ionized plasma of high temperature by energy amounts which do not exceed the heat content of the plasma by many orders of magnitude, a strong particle confinement has to be established. Particle losses along and across the field lines of a magnetic bottle should then be kept at the lowest possible level. The purpose of the present experiments is to investigate the interaction between a rotating plasma and a wall which is placed across the field of the magnetic bottle. The position of the wall can be changed and, within the same experimental device, it is then possible to compare conditions which closely correspond to the Homopolar, Ixion, and current loop configurations. For the latter, radial ratios of about 3.4 and mirror ratios of about 7.7 are obtainable in the present apparatus. The results show that the energy losses, the radiation from impurities and the gas released by interaction with the movable wall are reduced considerably when the conditions are changed from those corresponding to a Homopolar to those prevailing in a current loop device. For the latter the kinetic energy of the rotation can be kept at a slow rate of decay, from 135 to 15 joules within 0.6 milliseconds. From the results is concluded that the interaction between the plasma and its container walls can be reduced very much in a configuration with high radial and mirror ratios. The long containment times observed also indicate that the plasma is stable, at least with respect to the large losses of particles which would occur from the rapidly growing flute instabilities predicted by earlier hydrodynamic theories. (auth)

9753 CONTRIBUTION TO THE THEORY OF CONVERGING SHOCKS IN A PLASMA. J. P. Somon, J. G. Linhart, and H. Knoepfel (Euratom-C.N.E.N., Frascati, Italy). Nucl. Fusion, Suppl., 717-26(1962). (In French)

Results of computations on strong converging cylindrical or spherical shocks in plasma are presented. This enables one to evaluate the maximum neutron production from converging shocks in a D-T plasma. (auth)

9754 GENERATION OF SHOCKS IN A COLLAPSING CYLINDRICAL PLASMA SHELL. Ch. Maisonnier, J. G. Linhart, and M. Haegi (Euratom-C.N.E.N., Frascati, Italy). Nucl. Fusion, Suppl., 727-32(1962). (In English)

A theory is presented of the development of a cylindrical shock produced by the radial collapse of a thin cylindrical shell of plasma. The expected neutron flux from the shocked region is calculated. Experimental arrangement is described. This consists of an electrostatic injector producing a thin, annular beam of $LiAlD_4$ powder within a cylindrical evacuated chamber. This beam is first ionized and later accelerated radially by the discharge of a 40 kv, 50 kJ condenser bank. (auth)

9755 AMPLIFICATION OF MAGNETIC FIELDS AND HEATING OF PLASMA BY A COLLAPSING METALLIC SHELL. J. G. Linhart, H. Knoepfel, and C. Gourian (Euratom-C.N.E.N., Frascati, Italy). Nucl. Fusion, Suppl., 733-40(1962). (In English)

The principle is described of inertial confinement of plasma in which a cylindrical metallic shell compresses a magnetic field and plasma in a "soft-core" geometry. The shell transforms a part of its kinetic energy into the thermal energy of the compressed plasma and into the stored magnetic energy. The source of the kinetic energy of the shell can be either a condenser bank or an annular explosive charge. Two experiments, each using one of these energy-sources, are described. (auth)

9756 INVESTIGATION OF A TOROIDAL DISCHARGE IN A VARYING LONGITUDINAL MAGNETIC FIELD. D. P. Ivanov and K. A. Razumova. Nucl. Fusion, Suppl., 741-6(1962). (In Russian)

The results of experiments which were carried out in a toroidal chamber with a strong longitudinal magnetic field are presented. The structure of the chamber allowed an additional varying longitudinal magnetic field to be superimposed at any selected time during the discharge. All the experiments were carried out in a chamber degassed by a continuous thermal preconditioning technique. The compression and expansion of the plasma, which were observed alternately in an increasing and a decreasing longitudinal magnetic field, justify the statement that the plasma is appreciably magnetized. An estimate of the minimum magnitude of the transverse conductivity gives $\sigma \simeq 1 \times 10^{14}$ c.g.s. units while the longitudinal conductivity averaged over the cross section of the discharge amounts to $\sigma \simeq 1 \times 10^{15}$ c.g.s. units. The processes in the plasma are characterized by the appearance of sharp oscillations at a certain instant of time and by a corresponding decrease in current. The time of appearance of the oscillations is found to be dependent on various parameters. It is shown that the oscillations may be treated as magnetohydrodynamic instabilities of the first mode, provided it is assumed that the radius of the current is not equal to the radius of the diaphragm bounding the aperture of the chamber, but decreases with time at a rate of $\sim 10^4$ cm/sec. The experiments with a varying longitudinal magnetic field are consistent with the oscillations being treated in this way. (auth)

9757 CYCLOTRON ABSORPTION OF ELECTROMAGNETIC WAVES IN PLASMA. L. S. Bogdankevich, A. A. Rukhadze, and V. P. Silin. Nucl. Fusion, Suppl., 755-9(1962). (In Russian)

The magneto-bremsstrahlung and absorption of plasma is very important both in the energy balance of the plasma and in the particle velocity distribution. The problem of the shape of the "magneto-bremsabsorption" line has not yet been sufficiently studied. The form of the absorption lines in a non-relativistic electron-ion plasma on the basis of very general assumptions concerning the type of particle velocity distribution function. It is shown that consideration of relativistic effects in the thermal motion of particles can lead to a considerable absorption of waves propagation

across the magnetic field even in the case of non-relativistic plasma temperatures. As the absorption coefficient x and the refractive indexes n of the electromagnetic waves are expressed in terms of the particle distribution function, experiments on the measurement of n and x can be used for determining the distribution function. The problem utilizing ion cyclotron resonance for heating the ions in plasma is discussed. It is shown that electromagnetic waves with a frequency equal to double the resonance frequency of the ions can be used effectively for heating the plasma ions. (auth)

9758 FOKKER-PLANCK COEFFICIENTS FOR A PLASMA INCLUDING CYCLOTRON RADIATION. Norman Rostoker and Albert Simon (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Nucl. Fusion, Suppl., 761-6(1962). (GA-2480). (In English)

Kinetic equations for a plasma have previously been obtained by starting with the Liouville equation and making an expansion in powers of the discreteness parameters. To the lowest order in this expansion the Vlasov equations are obtained. In first order a Fokker-Planck equation is obtained where the coefficients come from the time-asymptotic solutions of integro-differential equations for the pair correlation functions. Solutions have been published for an infinite plasma with Coulomb forces, Coulomb forces and a constant magnetic field, the complete electromagnetic field and no constant magnetic field. In the present paper the complete electromagnetic field and a constant magnetic field are included. The new feature of this problem is that electromagnetic radiation obtains which was absent in all of the cases previously treated. At the outset, the system consists of a large number of "bare" particles that interact with each other and a denumerably infinite number of vacuum oscillators. The present statistical treatment leads to a kinetic equation for the one-body function that has a physical interpretation in terms of "dressed" particles and renormalized oscillators. A shield cloud of charge and current density envelopes a particle and the radiation takes place in terms of oscillators that satisfy the plasma dispersion relation instead of the vacuum dispersion relation. In the low-density limit, or when $k \gg \omega_p/c$, the result agrees with the vacuum radiation formula employed by Trubnikov. If terms of order $(\omega_p/kc)^2$ are retained, the principal effects is the renormalization of the oscillators. In the exact radiation formula longitudinal and transverse waves are coupled, i.e., the normal modes do not have a simple polarization. The virtue of the present treatment is that it indicates the terms that represent electromagnetic radiation and the proper particle dressing under these circumstances. (auth)

9759 A THEORETICAL STUDY OF THE NEUTRALIZATION OF A BEAM OF IONS BY INJECTION OF ELECTRONS. J. M. Dolique (Cie Générale de Télégraphic sans Fil, Orsay, France). Nucl. Fusion, Suppl., 767-73(1962). (In French)

The realization of a beam of ions, neutralized by injection of electrons, is capable of a great many extremely interesting practical applications: ionic propulsion, injection in a magnetic bottle for thermonuclear fusion purposes, plasma accelerators, etc. Experimentally, the attainment of a stable, mixed beam of great intensity presents considerable difficulty; hence the interest in a theoretical study of the problem. A model is developed which is more refined than those which have been envisaged up to the present. Time-dependent solutions are considered. (auth)

9760 ASYMPTOTIC THEORY OF HAMILTONIAN AND OTHER SYSTEMS WITH ALL SOLUTIONS NEARLY PERIODIC. Martin Kruskal (Princeton Univ., N. J.). Nucl. Fusion, Suppl., 775-95(1962). (In English)

Consider a system of N ordinary first-order differential equations in N dependent variables and let the independent variable s not appear explicitly. Let the system depend on a small parameter ϵ and possess a formal infinite power series expansion in ϵ, and suppose that the limiting system for $\epsilon = 0$ exists and has only periodic solutions. Then a formal solution can be constructed involving infinite power series in ϵ and satisfying the equations over large domains of s (of order $1/\epsilon$). The true solutions of the system exist over such domains and are asymptotically represented as $\epsilon \to 0$ by the formal solutions. The construction is based on the standard type of formal series solution of a "reduced" system of N—1 equations in N—1 dependent variables and with the new independent variable $\sigma = \epsilon s$; the omitted variable is essentially an angle variable φ describing the phase around the simple closed curves. If the original system is Hamiltonian, then one can define the usual action integral $J = \int p \cdot dq$ to all orders; the integral is taken around the phase ring. It is proved that J is an integral of the system and that the Poisson bracket of φ with J is unity, both to all orders. The usefulness of this particular integral is that it is computable locally. The reduced system, after elimination of another dependent variable by means of the constancy of J, can itself be put in Hamiltonian form; if its solutions are nearly periodic, the whole procedure can be reapplied. The present theory encompasses previous proofs of adiabatic invariance to all orders for particular systems such as the harmonic oscillator, the nonlinear oscillator, the charged particle gyrating tightly in a given electromagnetic field, and the longitudinal back-and-forth motion of such a particle trapped between two "magnetic mirrors" in a weak electric field. There are many other applications. (auth)

9761 TRANSPORT AND CONTAINMENT OF MOVING PLASMA CONCENTRATIONS (HIGH FREQUENCY AND MAGNETIC PLASMA WAVE-GUIDES). G. A. Askaryan, M. L. Iovnovich, M. L. Levin, and M. S. Rabinovich. Nucl. Fusion, Suppl., 797-800(1962). (In Russian)

The extensive possibilities of stabilizing the form and trajectory of dense plasma bunches moving rapidly across a system of spatially inhomogeneous fields of high frequency are outlined. In the coordinate system of the moving bunch, the spatially inhomogeneous fields are assumed to be high-frequency fields. For the purpose of theoretical consideration, the model chosen was an infinitely conducting plasma bunch with a sharp boundary (the dimensions of which are small compared to the characteristic dimension of the fields). In the combination of a fluted field of amplitude H_0 and the first harmonic of a screw-shaped field of amplitude H_1 the conditions of equilibrium, stability, and axial focusing are fulfilled for $H_0/(1 - M) = H_1/(1 + M)$ where M is the demagnetizing factor for the spheroidal bunch. If in this case one uses an H_0-wave instead of the fluted field, then the equilibrium and focusing conditions are fulfilled at $(\lambda/\lambda_B)^2 < \frac{1}{3}$ and $L < 2\sqrt{2}\lambda\lambda_B/\sqrt{4\lambda_B^2 - 3\lambda^2}$ (for $M = \frac{1}{3}$) where λ, λ_B are the wavelengths in free space and in the wave-guide, respectively, and L is the period of the screw-shaped field. In addition to these cases, the combinations of a circularly polarized E_1 wave with a fluted or a stellarator field are discussed. The conditions are evaluated under which the simplifying assumptions adopted (small dimension of the plasma bunch, screening of the fields, possibility of averaging the effect of the fields) are true. The results achieved can be used for creating magnetic and high-frequency plasma guides which are intended for the transport, acceleration, and

injection of plasma bunches with maintenance of their energy concentration. Simultaneous heating of the moving bunches is possible during their transit through inhomogeneous magnetic fields (with Foucault currents or pulsations or with high-frequency fields). (auth)

9762 STABILITY CRITERION OF A HYDROMAGNETIC TOROIDAL SYSTEM WITH SCALAR PRESSURE. C. Mercier (Euratom-CEA, Fontenay-aux-Roses, France). Nucl. Fusion, Suppl., 801-8(1962). (In French)

A study is made of plasma stability conditions for localized displacements. A criterion has already been found in the case of axial symmetry which, in cylindrical symmetry, becomes the Suydam criterion. A necessary and sufficient condition is established for localized displacements, which condition applies to any toroidal plasma. The condition of stability should be valid on every closed magnetic line in the plasma. These lines are on the constant-pressure surfaces characterized by the surface invariant $\iota(p)/2M = \delta\psi/\delta\psi$ taking the rational values m/n. The quantity $\delta\psi$ is the flux of B between two neighboring p-surfaces along a closed line making one small loop and no large one; $\delta\psi$ is the flux of B between two neighboring p-surfaces along a closed line making a large loop; m and n are the numbers of the large and small loops which the magnetic line makes before closing. With this notation, the stability condition may be written as: $Q_{n,m} > 0$. Except for a special case (axial symmetry) this expression takes different values for closed magnetic lines traced on the same constant pressure surface S. Meanwhile, when the numbers m and n tend to infinity, the stability condition is expressed with the aid of a surface integral and the values of $Q_{\infty,\infty} > 0$ for the different neighboring surfaces are continuous. (auth)

9763 HYDROMAGNETIC STABILITY OF A TOROIDAL PLASMA. M. Bineau (Euratom-Max-Planck-Institut für Physik und Astrophysik, Munich). Nucl. Fusion, Suppl., 809-13(1962). (In French)

The variational problem in the study of the minimal energy integral is developed for a toroidal plasma using the energy principle of Bernstein, Frieman, Kruskal, and Kulsrud [Proc. Roy. Soc. A 244 (1958) 17]. (auth)

9764 THE BROADENING OF SPECTRAL LINES IN A STRONGLY IONIZED PLASMA. M. A. Mazing and N. A. Vrublevskaya. Opt. Spectr. (USSR) (English Transl.), 13: 172-4(Sept. 1962).

The broadening of lines of Ne II and Kr II in a spark discharge is investigated experimentally; the results obtained agree with results for lines of Ar II and He I. Comparison with the nonstationary theory of line broadening shows that this theory satisfactorily describes the broadening of lines with high or medium values of the quadratic Stark-effect constant. If the values of these constants are low, i.e., of the order 10^{-15} cm^4/sec, this theory does not apply. Comparison with results obtained for lines of Ar II leads to the conclusion that the line shift is correctly described by the theory, but that additional assumptions are required for the quantitative calculation of the width of such lines. (auth)

9765 PLASMA STABILITY IN A DISCHARGE OF INVERSE STRICTION TYPE. P. H. Rebut and A. Torossian (Commissariat à l'Energie Atomique, Gif-sur-Yvett, France). Phys. Letters, 2: 52-3(Aug. 1, 1962). (In French)

Inverse hard-core pinches are studied using magnetic, electrostatic, and thermal probes and spectroscopic methods. It is found that under certain conditions a stable plasma is formed. The plasmas studied have temperatures on the order of 30 ev, kinetic pressures of 0.1 kg/cm^2, and $\beta \cong 0.2$. Both cylindrical and helical equilibria are observed in the plasma. (T.F.H.)

9766 NEUTRONS FROM A Θ PINCH WITHOUT REVERSED TRAPPED FIELD. L. M. Goldman, H. C. Pollock, J. A. Reynolds, and W. F. Westendorp (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. Letters, 9: 361-3(Nov. 1, 1962).

In several theta-pinch experiments a strong correlation has been found between the neutron yield in a deuterium plasma and the presence of reversed trapped field, and it has been concluded that such trapped fields are essential to the neutron production mechanism. The present experiments show that yields up to 10^8 neutrons may be produced at low pressures without reversed trapped magnetic fields and under initial conditions of negligible parallel and B_θ trapped fields. (H.D.R.)

9767 PROPAGATION AND DAMPING OF ION ACOUSTIC WAVES IN HIGHLY IONIZED PLASMAS. A. Y. Wong, N. D'Angelo, and R. W. Motley (Princeton Univ., N. J.). Phys. Rev. Letters, 9: 415-16(Nov. 15, 1962). (MATT-149)

Experiments are described on the generation, propagation, and damping of ion waves in highly ionized cesium and potassium plasmas produced by surface ionization of atoms on a hot tungsten plate. Phase velocities of 1.3×10^5 cm/sec in cesium and 2.5×10^5 cm/sec in potassium are 70% higher than the theoretical values, but the ratio of the velocities, 1.9, is in good agreement with the theoretical value, 1.85. The damping distance, δ, was measured. In both Cs and K, $1/\delta$ varies linearly with frequency, therefore the damping distance is a constant fraction of wave length. The damping distance is independent of plasma density between $n = 6 \times 10^{10}$ and 5×10^{11} cm^{-3}, and $\delta_K/\delta_{Cs} = 2.2 \pm 0.3$, or approximately in the ratio $(m_{Cs}/m_K)^{1/3}$. These results appear as evidence for collisionless damping of ion waves. (H.D.R.)

9768 INVESTIGATION OF PLASMA CONFINEMENT IN A TOROIDAL THETA-PINCH WITH M + S-LIKE CONFIGURATIONS. U. Grossman-Doerth, W. Lotz, E. Remy, and G. Wolf (Max-Planck-Institut für Physik und Astrophysik, Munich). Phys. Rev. Letters, 10: 5-7(Jan. 1, 1963).

Experimental results on the confinement of a low-β plasma in a corrugated toroidal theta-pinch are reported. Ar and He are used. (T.F.H.)

9769 GENERAL EXPRESSIONS OF ABSORPTION COEFFICIENT AND RADIATION INTENSITY IN PLASMA AND KIRCHHOFF'S LAW. Kazuo Yamada (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto), 28: 599-606(Oct. 1962). (In English)

General expressions for the absorption coefficient $K(\omega)$ and radiation intensity $I(\omega)$ in plasma are given from the time variation in the number distribution function of incident photons, and in terms of these quantities Kirchhoff's law in plasma is discussed. This law represents a general relation between $K(\omega)$ and $I(\omega)$, which does not depend on a particular process that results in the absorption or emission of photons, but only on the temperature. The formal aspects of this relation are given from general expressions of $K(\omega)$ and $I(\omega)$. Furthermore, using the parallel discussion of the photon case, it is shown that Landau damping of plasma oscillations may be interpreted as a net damping of the plasmon distribution function as a result of the direct interaction with the electron. (auth)

9770 EVALUATION OF PLASMA PULSE ACCELERATOR. N. I. Kolosnitsyn. Vestn. Mosk. Univ., Ser. III, No. 4, 18-23(July-Aug. 1962). (In Russian)

Acceleration of ideally conducting plasma by a magnetic piston, forcing the plasma into a vacuum, was studied.

The acceleration was achieved using two parallel fuses with a discharge between them. The efficiency of the scheme (ratio of directed gas kinetic energy to the electromagnetic energy) was evaluated. (tr-auth)

9771 THE THEORY OF STANDING WAVES IN CONFINED PLASMA. R. Leven. Vestn. Mosk. Univ., Ser. III, No. 4, 30-9(July-Aug. 1962). (In Russian)

A dispersion equation was derived for standing waves in confined plasma excited by two electron beams moving toward each other. The system instability as a function of the electron beam velocity and density was found for given electron concentrations in the plasma. An expression was also found for the amplitude of standing waves excited near the unstable boundary. (tr-auth)

9772 THERMAL FLUCTUATIONS OF PLASMA. V. P. Milant'ev and Yu. A. Popov. Vestn. Mosk. Univ., Ser. III, No. 4, 55-9(July-Aug. 1962). (In Russian)

Space-time correlation functions of equilibrium plasma, where electron interactions with stationary ions are calculated by means of an effective frequency $\underline{\nu}$ and where the interaction friction force is postulated to be proportional to electron velocities, are developed. The calculations are made using the simplified Gibb's method that involves no correlations of incidental fields. (R.V.J.)

9773 A NEW METHOD FOR THE MEASUREMENT OF THE VELOCITY AND ELECTRIC CONDUCTIVITY OF A PLASMA. Heinrich Schindler (Siemens-Schuckertwerke A. G., Erlangen, Ger.) Z. Angew. Phys., 14: 538-41 (Sept. 1962). (In German)

The determination of the conductivity of plasma and the radial velocity of the charge carriers in a linear pinch discharge is not possible with the usual load probes alone. Therefore a probe was developed that permits the product of the conductivity and velocity to be measured. This occurs in principle by the determination of the current which originates from the deflection of the moving charge carriers in an auxiliary magnetic field. Measurements on linear pinch discharges show good agreement with the values to be expected from calculations and optical measurements. Combined measurements with the probe described and with load probes and simultaneous recording of the transient pattern of the total current and the imposed voltage yields all magnitudes necessary for the electrodynamic description of the linear pinch effect. (tr-auth)

9774 OBSERVATION OF THE DOUBLE-JET IONIC INSTABILITY IN THE CASE OF TURBULENT HEATING OF PLASMA. M. V. Babykin, E. K. Zavoiskii, L. I. Rudakov, and V. A. Skoryupin. Zh. Eksperim. i Teoret. Fiz., 43: 1976-8(Nov. 1962). (In Russian)

The turbulent electron heating method, satisfying the condition $T_i < \frac{1}{2}Mu^2 < T_e$, where u indicates the relative velocity of colliding plasma clusters, M = the mass of the ion and T_i and T_e = the temperature of the ions and electrons, respectively, was used for investigating the anomalous scattering of plasma jets; using a previously described method (Zhur. Eksperim. i Teoret. Fiz. 43, 1547 (1962)). The maximum velocity of the jets was 1.4×10^7 cm/sec; their density was (2 to 5) $\times 10^{13}$ cm^{-3}. The 2 jets were directed against each other in a 3.6-cm diameter quartz tube in uniform magnetic field of 600 oersted, interpenetrating each other in a resonant circuit used for heating the electrons. The applied 10^7-herz field created a high frequency of 1200 oersted at the axis of the plasma column, heating the electrons to 300 to 400 ev within 02 microsec. Results showed a strong mutual scattering of the plasma jets; this phenomenon, which cannot be explained by Coulomb collisions, was observed only at high plasma temperatures; it may be attributed to ion scattering effects by the small electric fields induced in the plasma by the instability arising from the double-jet ion motion. (TTT)

9775 INVESTIGATION OF DIFFUSION OF CHARGE CARRIERS IN IONIZED GASES BY THE DIFFUSION WAVE METHOD. V. S. Golubev (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 1985-90(Dec. 1962). (In Russian)

Diffusion coefficients of charged particles in ionized rarefied gases (H_2, He, Ne, Ar, Kr, and Xe) are measured by the diffusion wave method. For pressures between 0.03 to 1 mm Hg, magnetic fields up to 1.5 kOe, ion concentrations 10^8 to 10^{10} cm^{-3}, and electron temperature ~ 1 ev, the dependence of the transverse diffusion coefficient on magnetic field strength in most cases corresponds to the theory of pair collisions between the charged particles and neutral molecules. (auth)

9776 INVESTIGATION OF VACUUM ULTRAVIOLET RAYS FROM POWERFUL PULSED DISCHARGE. V. D. Pismennyi, I. M. Podgornyi, and Sh. Sukever (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 43: 2008-14 (Dec. 1962). (In Russian)

Results of an investigation of the radiation between 150 and 2200 Å from a powerful pulsed discharge are presented. It is shown that for a discharge current of 200 ka the ion temperature is 200 ev and the electron temperature is 20 ev. The cause of the difference between the electron and ion temperature is discussed. (auth)

9777 NON-EQUILIBRIUM ELECTRON AND PHONON SYSTEMS IN AN EXTERNAL MAGNETIC FIELD. P. S. Zyryanov and G. G. Taluts (Inst. of Physics of Metals, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2136-42(Dec. 1962). (In Russian)

The quantum as well as classical kinetic equations for electrons interacting with a quantized Bose field in the presence of an external homogeneous magnetic field are presented. The equations describe the interaction of electrons with various oscillation branches of an electron-ion plasma as well as of a solid body. Closed formulas are derived for some of the kinetic coefficients. The Fokker-Planck coefficients are calculated for the case of a strong magnetic field. (auth)

9778 RADIATION OF LOW FREQUENCY WAVES BY IONS AND ELECTRONS IN A MAGNETOACTIVE PLASMA. V. I. Pakhomov and K. N. Stepanov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 43: 2153-65(Dec. 1962). (In Russian)

The radiation of ion-cyclotron and magnetohydrodynamic waves by the ions and electrons of a high-temperature plasma in a magnetic field is considered. The emission and absorption coefficients of the plasma and the equilibrium intensity of the radiation are determined. (auth)

9779 A WEAKLY TURBULENT PLASMA IN A MAGNETIC FIELD. B. B. Kadometsev and V. I. Petviashvili. Zh. Eksperim. i Teor. Fiz., 43: 2234-44(Dec. 1962). (In Russian)

Equations describing the behavior of a weakly turbulent plasma in a magnetic field are derived by taking into account interaction between the waves. In such a plasma the interaction between various oscillations is sufficiently small and can be taken into account by expanding in powers of the square of the oscillation amplitude. The problem of anomalous diffusion of a plasma in a magnetic field in the presence of oscillations is discussed. (auth)

9780 CONDUCTIVITY OF PLASMA MEDIA IN THE PRESENCE OF A DRIFT. V. I. Pustovoit (Lebedev Inst.

of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 43: 2281-9(Dec. 1962). (In Russian)

The alternating-current conductivity of a plasma medium is considered, and it is demonstrated by the kinetic equation method that in the presence of a drift with a velocity exceeding the phase velocity of a certain wave the conductivity becomes negative. The appearance of a negative conductivity is connected with the directed motion of the space charge. The dependence of the conductivity on frequency is investigated, and it is shown that the effect occurs only at low frequencies. The conductivity is also derived by taking into account the magnetic field, and it is shown that in a weak field for which the electron cyclotron frequency ω_H is smaller than the collision frequency v, the elementary formula is valid. In a strong magnetic field, $\omega_H \gg v$, the conductivity may also be negative, provided the drift velocity in the magnetic field exceeds the phase velocity of the waves. It is shown that a consequence in the magnetic field exceeds the phase velocity of the waves. It is shown that a consequence of taking into account the dependence of the collision frequency on velocity is renormalization of the drift velocity. (auth)

9781 STABILITY OF IONIC LONGITUDINAL OSCILLATIONS OF PLASMA IN MAGNETIC FIELD. V. N. Oraevskii. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 39-41 (Sept.-Oct. 1962). (In Russian)

The oscillation stability of nonlinear stationary longitudinal plasma in a magnetic field was studied. It was found that at certain parameters longitudinal oscillations are unstable with respect to the excitation of two transverse waves. (R.V.J.)

9782 ON HYDRODYNAMICS OF RELATIVISTIC PLASMA IN MAGNETIC FIELD. G. M. Zaslavskii. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 42-7(Sept.-Oct. 1962). (In Russian)

The Chew, Low, and Goldberger method was applied in developing a hydrodynamic equation for a relativistic plasma in a magnetic field. The small-amplitude wave propagation problem was resolved and the stability criterion for propagation transverse to the magnetic field was found. (R.V.J.)

9783 ELECTRON HEATING IN MOVING PLASMA. V. M. Eleonskii and Yu. Ya. Polyak. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 48-51(Sept.-Oct. 1962). (In Russian)

The heating of electrons in a plasma flux moving with constant velocity across a magnetic field was studied. It was assumed that the heating is specified by $E_0 = 1/c\ U \times B$. The relation between electron temperature and plasma temperature was found for weakly and strongly ionized plasmas. Correlations of mean energy values, calculated according to precise distribution functions and in hydrodynamic approximation, were made for a model with constant mean free path. (R.V.J.)

9784 THERMAL AND ELECTRIC CONDUCTIVITY OF PARTIALLY IONIZED GAS. A. F. Nastoyashchii and L. D. Puzikov. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 52-8 (Sept.-Oct. 1962). (In Russian)

Precise expressions describing electron and ion kinetics were derived by expanding distribution functions in kinetic equations for electron, ion, and neutral atom mixtures and were developed according to field, concentration, and temperature gradients. The approximation holds for small variations in the particle mean free path. (R.V.J.)

9785 PLASMA HYDROMAGNETICS. Sixth Lockheed Symposium on Magnetohydrodynamics. Daniel Bershader, ed. Stanford, California, Stanford University Press, 1962. 151p. $4.50.

Eight papers are included; separate abstracts have been prepared for 5. The remaining 3 papers were previously abstracted in NSA. (T.F.H.)

9786 APPLICATION OF PLASMA PHYSICS TO PROBLEMS IN SOLAR PHYSICS. R. Luest (Massachusetts Inst. of Tech., Cambridge). p.40-6 of "Plasma Hydromagnetics." Stanford, California, Stanford University Press, 1962.

Magnetohydrodynamic and thermodynamic properties of the solar photosphere, chromosphere, and corona are outlined. (T.F.H.)

9787 ENERGY AND MOMENTUM IN THE THEORY OF WAVES IN PLASMAS. P. A. Sturrock (Stanford Univ., Calif.). p.47-57 of "Plasma Hydromagnetics." Stanford, California, Stanford University Press, 1962.

The introduction of the concepts of pseudo-energy and pseudo-momentum in plasma is discussed. The relation of these properties to wave phenomena in plasma is studied. The pseudo-energy and pseudo-momentum are uniquely defined by the amplitudes assigned to waves in the linearized theory. The existence of negative pseudo-energy is discussed. (T.F.H.)

9788 ABSORPTION OF MAGNETOHYDRODYNAMIC WAVES IN THE LOWER IONOSPHERE. Robert Karplus (Univ. of California, Berkeley). p.83-96 of "Plasma Hydromagnetics." Stanford, California, Stanford University Press, 1962.

The propagation of small-amplitude low-frequency electromagnetic waves in the ionosphere below 500 km altitude is studied. It is assumed that no atmospheric heating is produced by the wave, and electron-ion collisions are neglected. (T.F.H.)

9789 SHOCK WAVES AND COLLISION-FREE PLASMAS. R. M. Patrick and M. Camac (Avco-Everett Research Lab., Everett, Mass.). p.97-123 of "Plasma Hydromagnetics." Stanford, California, Stanford University Press, 1962.

Collisionless shock waves in annular shock tubes are studied. Measurements are made of the magnetic field variation across the shock wave, the radiation from the shock-produced plasma (which measurement yields the electron temperature), and the heat transfer and energy loss from the plasma to the wall. (T.F.H.)

9790 PARTICLE INTERACTIONS IN A PLASMA. W. B. Thompson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.137-46 of "Plasma Hydromagnetics." Stanford, California, Stanford University Press, 1962.

It is assumed that in any plasma, the potential energy of a particle is very small with respect to the average kinetic energy of the plasma particles. It is argued that the correlation function represents the displacement ($\delta \underline{r}_i$) produced in the position ($\underline{r}_i$) of the i'th particle by the field at $\underline{r}_i$; that in calculating the field, allowance must be made for the charge distribution produced by these displacements; and that since the correlations are small, $\delta \underline{r}_j$ may be calculated to first order in the forces. This first-order calculation, however, is equivalent to taking into account the polarizability of the plasma. This calculation is carried out using an approximate form of the Fokker-Planck transport equation. The result is used to calculate the scattering of electromagnetic radiation by the plasma. (T.F.H.)

9791 ELECTRICAL CONDUCTIVITY MEASUREMENTS ON CESIUM VAPOUR AND CESIUM PLUS INERT GAS MIXTURES. J. C. Ralph (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Preprint Paper 30, Session II. Prepublication Copy. 6p.

Experiments are described in which measurements were made of alkali-metal vapors and inert-gas-plus-vapor mixtures in thermal equilibrium at temperatures up to 2000°C. Two closely spaced plane probes were inserted into a furnace containing the vapor to be tested, and the voltage-current characteristics of the probes were measured. Diagrams and a description of the experimental apparatus, the experimental procedure, and the results obtained for Cs vapor and cesium–argon mixtures are presented. (M.P.G.)

9792 THE CONDUCTIVITY OF SEEDED COMBUSTION PRODUCTS AT 2460°K. M. S. Jones, Jr. and C. N. McKinnon (MHD Research Inc., Newport Beach, Calif.). Preprint Paper 36, Session II. Prepublication Copy. 13p.

Experiments to determine the effect on electrical conductance of variations in electrode length, wall and electrode temperature, and gas temperature are described, and data are presented. Ethyl alcohol fuel, with dissolved KOH seed, and gaseous oxygen were ignited to form the combustion-product gases. Results indicate that the average conductivity of the gas depends on the temperature and seed level of the gas and the value of the applied electric field. For electric fields below 15 v/cm, the electric conductivity of combustion products seeded with 1% K was found to be 0.09 mho cm^{-1}. This agrees with Frost's theoretical calculation. For higher electric fields, a nonlinear voltage-current relationship was observed. (M.P.G.)

9793 CONDUCTIVITY MEASUREMENTS IN SEEDED COMBUSTION GASES. R. Devime, H. Lecroart, Xn'guyen Duc, J. Poncelet, and P. Ricateau (Commissariat a l'Energie Atomique, Saclay, France and l'Institut Francais du Petrole, Rueil-Malmaison, France). Preprint Paper 32, Session II. Prepublication Copy. 18p.

Experimental equipment to study the interactions between seeded combustion gases and electrodes is described. The main components are a combustion chamber and a conductivity measurement cell. The characteristic curves, V = f(j), are presented and analyzed for two experiments. (M.P.G.)

9794 PRELIMINARY MEASUREMENTS OF THE INSULATION THICKNESS OF THE BOUNDARY LAYER BEHIND STRONG SHOCKS IN ARGON. R. J. Hill (Rolls-Royce Ltd., Derby, Eng.). Preprint Paper 28, Session II. Prepublication Copy. 11p.

Experiments are described which were carried out to obtain basic information on the effect of the boundary layer in conductivity experiments. The effective thickness of the insulating layer was measured by determining the capacity between plates in the wall of the tube and the plasma. Preliminary measurements are reported and indicate that the capacitance probe technique can provide information in reasonable agreement with other properties observed. The boundary layer was found to be thinner than predicted by calculations neglecting diffusion. (M.P.G.)

9795 RESEARCH ON THE ELECTRICAL CONDUCTIVITY OF COMBUSTION PRODUCTS WITH POTASSIUM SEEDING. E. P. Zimin and V. A. Popov (Academy of Sciences, Moscow). Preprint Paper 21, Session II. Prepublication Copy. 12p.

Three methods of measuring the electric conductivity of combustion gases are described, and data from each method are presented and compared. In the microwave attenuation method, measurement of the attenuation of electromagnetic waves traveling through a medium permits the parameters of the medium to be determined. In the resonant circuit method, the flame conductivity can be determined by measuring the variation of the quality factor or resonant frequency of a circuit. The double-probe method was also used, and the data were corrected by semi-empirical relationships, since probe measurements are not accurate at high pressures. Measurements of conductivity by the three methods were found to agree well among themselves when the experimental data are appropriately processed. (M.P.G.)

9796 EXPERIMENTAL ERRORS IN MAGNETIC PROBE STUDIES. M. R. Barrault, J. Lebat, and A. N. Prasad (Univ. of Liverpool). Preprint Paper 18, Session II. Prepublication Copy. 9p.

An analysis is made of magnetic probe measurements in plasma research. Some causes of errors are transients, phase shift, probe shielding effects, and cable attenuation. It is concluded that nondisturbing methods of measurement are preferable in plasma studies, since a probe will cause cooling of the plasma due to the increase in the radiation flux from the discharge. (M.P.G.)

9797 ELECTRICAL CONDUCTIVITIES OF SEEDED FLAME PLASMAS WITH APPLIED ELECTRIC FIELDS. M. Lapp and J. A. Rich (General Electric Research Lab., Schenectady, N. Y.). Preprint Paper 9, Session II. Prepublication Copy. 14p.

An experimental arrangement to measure the conductivity of flame plasmas is described, and measured values are presented for the conductivity of C_2H_2/Air/K and H_2/O_2/K flame plasmas. Good agreement between measured and calculated conductivities for the C_2H_2/Air/K flame plasma was obtained. An anomalous increase in conductivity with current density was observed for the H_2/O_2/K system, which was probably due to nonthermal processes. For the C_2H_2/Air/K system, the increase of conductivity with current density could be accounted for through thermal processes involving Joule heating. (M.P.G.)

9798 A NOTE ON ELECTRON-ION RECOMBINATION IN ARGON. K. N. C. Bray and J. A. Wilson (Univ. of Southampton, Eng.). Preprint Paper 4, Session IV. Prepublication Copy. 6p.

A mechanism is postulated for the recombination of electrons and ions in high-temperature, highly ionized argon, assuming that the rate of ionization is limited by the rate of excitation. A recombination rate which increases exponentially with falling electron rate is obtained. The rate equation is inaccurate at low temperatures and ionization levels. Results of numerical computations are presented in graphical form. It is shown that the flow will be far from both frozen and equilibrium limits. Electron temperatures in excess of ion-atom temperatures are predicted. (M.P.G.)

9799 A CRITERION FOR ASSESSING METHODS OF PRODUCING NON-EQUILIBRIUM IONIZATION. A. Maitland (C. A. Parsons and Co. Ltd., Fossway, Newcastle upon Tyne, Eng.). Preprint Paper 10, Session IV. Prepublication Copy. 6p.

A new method for assessing ways to produce nonequilibrium ionization is proposed. The energy, q, required to produce one electron-ion pair in unit mass of the system by the nonequilibrium method is calculated and compared to the energy, Q, required by the equilibrium method. A criterion for a practical method of producing nonequilibrium ionization is that the ratio Q/q for a given process at temperature T be less than or equal to 1. Methods for calculating Q and q are presented. The photoionization of Cs–He mixtures is assessed by this new method. It is shown that photoionization is a more efficient method than heating the gas under certain conditions. Other advantages

of photoionization as a method of producing nonequilibrium ionization are listed, and it is suggested that some type of laser might be a suitable source of high-intensity light. (M.P.G.)

9800 NON-EQUILIBRIUM IONIZATION IN FLAMES. A. N. Hayburst and T. M. Sugden (Cambridge Univ., Eng.). Preprint Paper 15, Session IV. Prepublication Copy. 6p.

An analysis of flames with greater than equilibrium ionization is presented. The reactions in premixed H_2, O_2, N_2, and hydrocarbon flames are discussed, and the ionization of metallic additives and alkali metals in flames is examined. It is shown that, in the cases studied, the presence in the flame of free radicals, whose concentrations may be much greater than their equilibrium values, causes the excess ionization. (M.P.G.)

9801 DETERMINING THE OPTIMUM COMPOSITION OF GASEOUS MIXTURES IN THE PRESENCE OF SEEDING. E. P. Zimin and V. A. Popov (Academy of Sciences, Moscow). Preprint Paper 24, Session IV. 15p.

The conductivity of a mixture of an ionizable gas with a nonionizable one over a large temperature range is analyzed theoretically. The variation of conductivity with the composition of the mixture is studied, and it is shown that good conductivities can be obtained with moderate seeding without excessively high temperatures. Optimum mixtures with a maximum conductivity at a given temperature are determined for certain gases. The influence of the magnetic field on the optimum composition of the mixture is also studied, and it is shown that magnetic fields strongly affect the value of the optimum seeding. It is concluded that, within certain temperature and pressure limits, conductivities 5 to 10 times as great as the conductivity of the pure metal can be obtained by diluting the gases of easily ionizable metals with practically nonionisable gases. (M.P.G.)

9802 THEORETICAL ANALYSIS OF THERMOELECTRIC CHARACTERISTICS OF AN IONIZED FLUID. R. Monti and L. G. Napolitano (Universitá, Naples). Preprint Paper 41, Session IV. Prepublication Copy. 8p.

A unified irreversible thermodynamic analysis of conversion processes with n independent fluxes and forces is presented. The coefficients of conductivity (ratio between fluxes and forces), force cross-effect (ratio between two forces), and flux cross-effect (ratio between two fluxes) are self-consistently defined, and their values are derived in terms of the kinetic phenomenological coefficients. A general definition of figure of merit is proposed and is valid when more than one cross-effect is present. The application of the analysis to a ternary equilibrium isotropic plasma is outlined. The value of the force cross-effect (Seebeck) coefficient was determined and found to compare favorably with those of good semiconductors. (M.P.G.)

9803 HALL INSTABILITY OF CURRENT-CARRYING SLIGHTLY IONIZED PLASMAS. E. P. Velichov (Kurchatov Inst. of Atomic Energy, Moscow). Preprint Paper 47, Session IV. Prepublication Copy. 27p.

A theoretical analysis is presented of the flow of a "low-conductivity" fluid in an external magnetic field. A precise condition for low-frequency current instabilities is derived, and the effect of fluctuations on the averaged plasma flow characteristics is evaluated. If current density in a plasma in a transverse magnetic field exceeds a critical value, pressure fluctuations will grow exponentially, and the flow will become turbulent. This will decrease the effective conductivity of the plasma and the efficiency of a segmented-electrode magnetohydrodynamic generator. (M.P.G.)

9804 PLASMAS. THEIR IMPORTANCE IN THE FLIGHT TESTING OF BALLISTIC MISSILES. H. A. Poehler (Space Technology Labs., Inc., Patrick Air Force Base, Fla.). Preprint Paper No. CP 63-111. New York, The Institute of Electrical and Electronics Engineers, 1963. 13p. $1.00.

Paper from Winter General Meeting, New York, Jan. 27-Feb. 1, 1963.

The basic properties of a plasma are reviewed. In particular, the propagation of electromagnetic waves in a plasma is presented. The importance of the plasma in the flight testing of ballistic missiles is illustrated by a discussion of flame attenuation, antenna breakdown, and reentry blackout. (auth)

9805 INTERACTION EFFECTS BETWEEN A PLASMA AND A VELOCITY-MODULATED ELECTRON BEAM. Gabriel Felisberto de Oliveira Freire. Thesis, Stanford, Calif., Stanford Univ., 1962. 131p.

The interaction between a grid modulated electron beam of finite diameter and a stationary plasma column, in the absence of a magnetic field, was investigated both theoretically and experimentally. Experiments performed with a beam-plasma tube, with modulation of the electron beam by grids, revealed a maximum interaction when the modulation frequency of the beam was equal to or near the plasma frequency of the plasma. An electronic gain of 7.5 db due to the plasma was observed. The output powers were low with no net gain in any condition, due to the low impedances of the cavities which were used, and to the low beam current available. Nevertheless, it was possible, by driving the beam to saturation power levels, to obtain fundamental components of the beam current such that $I_1/I_0 = 1.5$ near the resonance condition. With only the electron beam on the plasma being off, the saturation output current measured was about $0.8\ I_0$. The large saturation currents observed may be attributed to the fact that when $\omega < \omega_{pp}$ the plasma behaves like an inductive medium that has a similar effect to the inductively detuned intermediate cavity in a three-cavity klystron. Second harmonic signals were detected, and a maximum peak of the output signal was observed when the plasma frequency of the plasma was twice the modulation frequency of the beam. Another smaller peak was observed at $f \sim f_p$. The second-harmonic currents were shown to increase approximately by a factor of two, at input saturation powers, when the plasma density was increased from zero to a value such that $f_p \sim 2f$. The theoretical model, which was analyzed consisted of a perfectly conducting cylindrical waveguide completely filled by a lossless, uniform plasma. The electron beam was assumed to be modulated by a gridded gap. Two pairs of field solutions inside the beam region are shown to be possible. It is shown also that, under conditions for existence of growing waves in the system, strong harmonic generation becomes possible as a result of modifications of space-charge forces on the beam, due to the presence of the plasma. Expressions for the second-harmonic components of the relevant r-f quantities in the infinite beam-plasma system were derived, indicating the existence of growing second-harmonics. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9806 STABILITY OF A DENSE PLASMA CONFINED BY AN RF FIELD. Herbert William Lorber. Thesis, Philadelphia, Univ. of Pennsylvania, 1962. 50p.

A proposal made for confining a dense cusped plasma in the r-f magnetic field of a resonant cavity mode was examined critically for application in a practical controlled thermonuclear reactor. Following a brief description of some possible advantages of the use of r-f fields over d-c

fields for plasma confinement, a short list of characteristic numerical values is presented for a controlled DT reactor. It is shown that boundary conditions on a field-free plasma with a thin-plasma field interface are the same as those for a perfect conductor and that the average pressure of the rf field on the surface of the plasma is given in MKS units by $P = (1/4)(\mu_0 H^2 - \epsilon_0 E^2) - \overrightarrow{\rho v_n^2}$ where E and H are peak amplitudes, ρ is the total mass density of the plasma, and $\overrightarrow{v_n^2}$ is the mean square hydrodynamic velocity of the plasma normal to the surface. The result is obtained by writing the Lorentz force equation in terms of Maxwell's stress tensor and then taking the volume integral of this force per unit volume over a thin pillbox shaped region that has one face in the vacuum outside the plasma and one face inside the plasma where there is no field. In an example where a single velocity plasma is confined by an alternating magnetic field, it is shown that the hydromagnetic contribution, $-\overrightarrow{\rho v_n^2}$, reduces the pressure exerted on the plasma by approximately 20%. It is also shown that the plasma being confined has a cusped shape, that it is of finite extent, and that it is held away from the walls of the resonant cavity. Since the interior of the plasma is field free, any instabilities that might be capable of destroying the equilibrium of the confined plasma must be surface effects. These are the Rayleigh-Taylor instability due to the r-f expansion and compression of the plasma, the electrostatic instability due to the rapid motion of the surface electrons, which constitute the surface current, and the parametric instability due to the parametric excitation of nonconfining modes by the rapidly vibrating surface of the plasma. In order to combat the Rayleigh-Taylor instability a frequency is chosen for the confining field sufficiently high to violate the criteria for hydromagnetic behavior. It is shown that in this case the wall losses, even for a superconducting cavity would be prohibitive, not to mention losses due to absorption of bremsstrahlung and neutrons. In addition to all the difficulties there is a very severe thermodynamic penalty due to the need of the refrigerator cooling the cavity to take energy in at a few degrees Kelvin and exhaust it at room temperature. The number of watts needed to exhaust one watt absorbed by the cavity is approximately equal to the ratio of the two temperatures. It seems that r-f thermonuclear machines suffer greatly from many faults not shared by d-c machines. (Dissertation Abstr., 23: No. 5, Nov. 1962)

9807 GENERATION OF ENERGY BY CONTROLLED THERMONUCLEAR REACTION. (to Fabrik Elektrischer Apparate Sprecher and Schuh A. G.). British Patent 911,510. Nov. 28, 1962. Priority date May 4, 1959, Switzerland.

A method of generating energy by thermonuclear fusion reaction is described in which a plasma column formed by an electric arc within a container is used. (R.J.S.)

9808 IMPROVEMENTS IN OR RELATING TO THERMONUCLEAR PLASMA APPARATUS. Francois Prevot (to Commissariat à l'Energie Atomique). British Patent 913,469. Dec. 19, 1962. Priority date Apr. 20, 1959, France.

A thermonuclear reactor is designed with improved injection means. The reactor comprises an annular ion source producing a sheet-like ion beam, an ion-dissociation means, an annular accelerating electrode coaxial with the source, and means producing a magnetic field for confining the ions. Several embodiments of the accelerating electrode are described. (D.L.C.)

9809 APPARATUS FOR THE DENSIFICATION AND ENERGIZATION OF CHARGED PARTICLES. R. F. Post and F. H. Coensgen (to U. S. Atomic Energy Commission). U. S. Patent 3,069,344. Dec. 18, 1962.

This patent relates to a device for materially increasing the energy and density of a plasma to produce conditions commensurate with the establishment and promotion of controlled thermonuclear reactions. To this end the device employs three successive stages of magnetic compression, each stage having magnetic mirrors to compress a plasma, the mirrors being moveable to transfer the plasma to successive stages for further compression. Accordingly, a plasma introduced to the first stage is increased in density and energy in stepwide fashion by virtue of the magnetic compression in the successive stages such that the plasma upon reaching the last stage is of extremely high energy and density commensurate the plasma particles undergoing thermonuclear reactions. The principal novelty of the device resides in the provision of a unidirectional magnetic field which increases in stepwise fashion in coaxially communicating compression chambers of progressively decreasing lengths and diameters. Pulsed magnetic fields are superimposed upon the undirectional field and are manipulated to establish resultant magnetic compression fields which increase in intensity and progressively move, with respect to time, through the compression chambers in the direction of the smallest one thereof. The resultant field in the last compression chamber is hence of relatively high intensity, and the density and energy of the plasma confined therein are correspondingly high. (AEC)

9810 METHOD AND APPARATUS FOR PRODUCING THERMONUCLEAR REACTIONS. Nicholas C. Christofolis. U. S. Patent 3,071,525. Jan. 1, 1963. Filed Aug. 19, 1958.

An Astron-type apparatus is designed for producing controlled thermonuclear reactions. In the apparatus, an elongated, axially symmetric magnetic field is established in an evacuated vessel, and relativistic electrons are injected into the field to form a rotating sheath (E-layer) for effecting ionization, heating, confinement, and production of thermonuclear reactions. The theory and operation of the apparatus are discussed in detail. Parameters are given for a 500-Mw Astron reactor. (D.L.C.)

9811 THERMONUCLEAR REACTOR. Friedrich Schlelein. U. S. Patent 3,072,551. Jan. 8, 1963. Filed Mar. 6, 1959.

A thermonuclear reactor of the toroidal type is designed. The pinch effect is stabilized by a magnetic or electric field, or a high-frequency electric discharge. Several embodiments of the reactor are described. (D.L.C.)

Shielding

9812 (AD-272874L) DEVELOPMENT OF A LIGHTWEIGHT PLASTIC NEUTRON SHIELDING MATERIAL BASED UPON BORON COMPOUNDS WITH HIGH HYDROGEN CONTENT. Monthly Progress Report No. 4. W. H. Yanko and M. E. Ginn (Monsanto Research Corp. Dayton Labs., Ohio). Nov. 6, 1961. Contract DA-19-020-ORD-5458. 6p.

Activities in a program to identify boron compounds which are superior to boron-impregnated high-density polyethylene are reported. The literature survey was continued during the period, and the present tabulation contains 3825 boron compounds with atomic numbers 1 through 20. It is estimated that a complete literature search will yield about 4500 boron compound references. (J.R.D.)

9813 A METHOD OF APPROXIMATE EVALUATION OF INITIAL VALUES FOR SHIELDING COMPUTATIONS.

Lech Szymendera and Andrzej Strupczewski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika, 7: 445-53(1962). (In English)

A method is described for approximate evaluation of neutron-flux values at the core-reflector interface, using no data from criticality computations. In this method it is sufficient to know the basic data of reactor design, e.g., power, expected external surface of the core, and multiplication coefficient. The method is based on the multigroup removal-age-diffusion approximation that is used in shielding computations. (auth)

9814 ANGULAR DISTRIBUTION OF BACK-SCATTERING OF GAMMA RAYS FROM SHIELDING MATERIALS. K. A. Mahmoud and L. El Nady (Atomic Energy Establishment of the U. A. R., Egypt). Proc. Math. Phys. Soc. (U.A.R.), No. 24: 93-9(1960). (In English)

Results are given of an experimental investigation on the back scatter at the front face of a thick scattering barrier irradiated by a uniform beam of rays. The study was made for three different geometrical conditions; the whole plane, the half plane, and the corner. The gamma rays used had energies in the range 0.664 to 1.25 Mev and the scattering material was ordinary concrete of density 2.4 g/cm^3. The results are discussed in the light of the theoretical treatment advanced by Corner and Liston and by Cave et al. (auth)

9815 NEUTRON-ABSORBANT SHIELD. Bror Borge Skytte Jenson (to Atomenergikommissionen). British Patent 915,443. Jan. 9, 1963. Priority date Feb. 17, 1960, Denmark.

A neutron-absorbant shield is described which consists of or contains one or more boric acid esters of monoaliphatic alcohols containing 9 carbon atoms or more. (R.J.S.)

9816 RADIATION SHIELDING COMPOSITION. Harold L. Dunegan (to U. S. Atomic Energy Commission). U. S. Patent 3,075,925. Jan. 29, 1963.

A light weight radiation shielding composition is described whose mechanical and radiological properties can be varied within wide limits. The composition of this shielding material consists of four basic ingredients: powder of either Pb or W, a plastic resin, a resin plasticizer, and a polymerization catalyst to promote an interaction of the plasticizer with the plastic resin. Air may be mixed into the above ingredients in order to control the density of the final composition. For equivalent gamma attenuation, the shielding composition weighs one-third to one-half as much as conventional Pb shielding. (AEC)

Theoretical Physics

9817 (NP-12352) A REFORMULATION OF THE THEORY OF PAIRING CORRELATIONS. Technical Report No. 10. Michel Baranger (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). Nov. 1962. Contract Nonr-760(15). 37p.

A variational approach to the ground state of a many-fermion system is developed with the trial function of condensed pairs proposed by Blatt. The calculation of matrix elements is done by a diagrammatic method which is simpler than Blatt's. The method is susceptible of generalization to higher correlations. It is also shown that the theory is identical with Hartree-Bogolyubov theory. The Hartree-Bogolyubov equations are derived from the variational point of view. (auth)

9818 (WIS-NSF-19) THE SEPARATION OF THE ROTATIONAL COORDINATES FROM THE N-PARTICLE SCHROEDINGER EQUATION. [PART] III. Series 3. C. F. Curtiss (Wisconsin. Univ., Madison. Theoretical Chemistry Lab.). Apr. 9, 1962. 18p.

The separation of the rotational coordinates from the n-particle Schroedinger equation is discussed. The formalism is particularly applicable to the study nonadiabatic collisions between atoms. The approach exhibits, explicitly, the coupling terms, which are neglected in the Born-Oppenheimer approximation and which lead to changes in the electronic states of the atoms during a collision. (auth)

9819 ON STATISTICS OF PARTICLES WHICH CANNOT EXCHANGE THEIR PLACES. H. Stachowiak (Low Temperature Laboratory, Polish Academy of Sciences, Wroclaw). Acta Phys. Polon., 22: 335-47(Oct. 1962). (In English)

A quantum mechanical definition of a system whose particles cannot exchange their places is given. It is shown that in such a system a kind of Pauli exclusion principle relating to the spatial coordinates only is fulfilled, independently of the statistics of the particles. The energy levels and the density $\psi^*\psi$ are the same as for an antisymmetrical wave function. A simple example is given in which the influence of rare exchanges of places of the ground state energy is small. A special case of perturbation in the boundary conditions is considered. (auth)

9820 PATH INTEGRAL FORMULATION OF RELATIVISTIC QUANTUM MECHANICS. M. C. Goodall (Massachusetts Inst. of Tech., Cambridge). Nature, 196: 370 (Oct. 27, 1962).

9821 THE CANONICAL FORM OF AN ANTISYMMETRIC TENSOR AND ITS APPLICATION TO THE THEORY OF SUPERCONDUCTIVITY. Claude Bloch and Albert Messiah (Centre d'Études Nucléaires, Saclay, France). Nucl. Phys., 39: 95-106(Dec. 1962).

It is shown that a real or complex antisymmetric second order tensor transforming according to either the real orthogonal or the unitary group can always be put into a canonical form in which it appears as the direct sum of a zero matrix and of 2×2 antisymmetric matrices. This theorem is used to establish the necessary and sufficient relations satisfied by the contractions in the general Bogoliubov-Valatin transformation, and to put these contractions into a canonical form. The later result shows that the general Bogoliubov-Valatin transformation is always equivalent to a pairing in which each paired state is paired with only one other state. (auth)

9822 A CRITERION FOR THE FREE CHARACTER OF FIELDS. [PART] II. Jan Lopuszanski (Univ. of Warsaw). Nucl. Phys., 39: 169-73(Dec. 1962).

The clothed-particle formalism is shown to be of no practical use, since it leads either to an incomplete current or to a non-local field theory that violates not only the locality condition but also the Yang-Feldman equation. A proof is given that neither the current nor the Heisenberg field can be expressed as a polynomial (in a generalized sense) in the incoming (or outgoing) fields. This statement is based on the assertion that the outgoing field cannot be expressed as a polynomial with respect to the incoming fields unless both fields coincide. (auth)

9823 RELATIVISTIC QUANTUM THEORY OF PARTICLES WITH VARIABLE MASS. [PART] I. H. C. Corben. Proc. Natl. Acad. Sci., U. S., 48: 1559-66(Sept. 1962).

A relativistic quantum theory is presented of particles

with spin 0, ½, 1, 3/2, 2 which has as its classical limit the theory of a particle which possesses moments of inertia about more than one axis. (auth)

9824 REGULARIZATION OF THE CLASSICAL EQUATIONS OF ELECTRODYNAMICS. A. S. Kompaneets (Inst. of Chemical Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 43: 2185-7(Dec. 1962). (In Russian)

It is shown that by compensating the electromagnetic and meson fields, a relativistically invariant stable model of an extended charge can be obtained without introducing new constants into the theory. (auth)

9825 MULTIPLE DISPERSION RELATIONS. Yu. A. Simonov. Zh. Eksperim. i Teor. Fiz., 43: 2263-72(Dec. 1962). (In Russian)

The form of multiple dispersion relations which replace the Mandelstam representation for diagrams with an anomalous mass ratio and which are applicable to the case of many-channels process is considered. The integral Bergman—Weil representation is employed for this purpose. The structure of the representation is clarified in the particular case of a triangular diagram of the vertex part. A new singularity of the diagram is found which cannot be derived by the Landau method. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

Refer also to abstracts 7941 and 8885.

9826 (ACNP-62032) THREE-DIMENSIONAL ANALYSIS OF CANDU FOR CONTROL ABSORBERS AND FRESH FUEL INSERTION. Final Report. P. S. Lacy and W. E. Schilling (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). Dec. 6, 1962. Contract AT(38-1)-291. 59p.

A computer study program was performed to determine three-dimensional two-group flux distributions in the CANDU reactor with control absorbers and/or a single fresh fuel channel inserted into the equilibrium core. The principal objectives of this program were to determine the location of a fresh fuel channel which results in the most severe flux peaking with control absorbers positioned to maintain core criticality, and to establish the relationship of core quadrant power fractions and the power per channel within a quadrant to the insertion of the control absorbers and/or a fresh fuel channel. The control absorbers are inserted to compensate for the reactivity transient as well as to minimize changes in the core flux (or power) distribution associated with the replacement of an equilibrium fuel channel by a fresh fuel channel. During core operation the power per quadrant is monitored and the control absorbers are positioned to minimize differences in quadrant power densities. Nine three-dimensional calculations were performed. These calculations include one problem for the core with neither control absorbers nor fresh fuel inserted, four problems with control absorbers inserted, and four problems with control absorbers and a fresh fuel channel inserted. Supplemental one- and two-dimensional calculations were also performed to determine core flux distributions without control absorber insertion, to develop the control absorber constants, and to examine the amplitude of the first xenon induced oscillation. The maximum reactivity worth of a fresh fuel channel replacing an equilibrium fuel channel was calculated to be 0.40 milli-k assuming no power coefficient feedback. With power coefficient effects this value is reduced to 0.25 milli-k. The maximum increase in channel power upon insertion of a fresh fuel channel with control absorber compensation was calculated to be 8%. The core was computed to be marginally stable to xenon induced oscillations. The amplitude of the first xenon oscillation increased the static power peak by 1% for a total peaking increase of 9%. (auth)

9827 (AEEW-M-221) NOTES ON THE SENSITIVITY OF CALCULATED MODERATOR COEFFICIENTS TO THE MODEL AND CROSS-SECTIONS USED. C. F. Griggs and H. M. Sumner (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). 31p.

The effect of cross-section changes on the moderator temperature coefficient of reactivity of a Calder Hall reactor is investigated at various irradiations and temperatures. The method of calculation uses basic nuclear data and a detailed spectrum model and has been programmed for Mercury (Spectramet). Changes of 1% in certain cross-sections are found to change the moderator coefficient by 0.3 mn/°C over a wide range of irradiations. Moderator coefficients obtained with Spectramet and Carlson and with different scattering laws are compared and found to be similar. Reasonable agreement is obtained between the calculated results and the measurements on Calder Hall. (auth)

9828 (AEEW-R-184) THE VALIDITY OF SANDPIPER I. D. Hicks and M. C. Wilkinson (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Aug. 1962. 17p.

SANDPIPER I is a MERCURY program which derives few-group parameters for regular or near regular lattices of uranium dioxide moderated by light water, heavy water, or organic coolants. The validity of some of the simplifications which had to be introduced is discussed, and a comparison with experimental lattice data is presented. It is shown that an accuracy of approximately 1% is obtained in reactivity predictions which is sufficient for survey or initial design calculations. (auth)

9829 (AEEW-R-192) PERIOD METER OUTPUT IN RESPONSE TO TERMINATED RAMPS OF REACTIVITY. J. D. Cummins (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). July 1962. 15p.

The time behavior of the period meter output was determined for a range of total reactivity injections and reactivity rates. Some results which are directly applicable to graphite gas-cooled reactors are given. (auth)

9830 (BAW-1260) NS SAVANNAH UPGRADING ANALOG COMPUTER ANALYSIS. R. M. Rosser (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). Nov. 1962. Contract AT(30-1)-2721. 186p.

An extensive transient analysis was made of the NS Savannah power plant using analog computer technique to determine the control and safety system actions required to prevent plant damage following operating and accident transients. This work amplified previous design studies by considering accidents of greater severity, automatic limiting devices to preclude safety action, and more realistic parameters based on operating experience. The following transients were analyzed: startup accident, rod withdrawal accident in the power range, excessive steam demand, accidental closing of both steam stop valves, primary flow coastdown, capsize ship accident, ejection of one control rod, determination of maximum and minimum rates of reactivity change that should be available to the control system, and power change from 100 kw-t to 86 Mw-t to determine the reactivity required to maintain a 20-second period. The minimum rate of reactivity removal necessary to prevent plant damage considered to occur when heat flux exceeds the steady-state level corresponding to departure from nucleate boiling, when the central fuel temperature exceeds 5000°F, when primary system pressure exceeds 2200 psia, and when the core is not subcritical following a primary system rupture was considered. The effects of changing set points were also analyzed. The graded protective system automatically limits excursions from normal operating conditions by initiating corrective actions that, in order of increasing severity, are stop rods from withdrawing, insert rods at normal control speeds, and scram rods at high speed. Analysis of the graded protective system involved the selection of setpoints, with the setpoint for the least severe corrective action located closest to the operating value of the parameter. The analysis showed that overpressure considerations dictate the maximum required rate of reactivity removal, which is 3% δk per second.

This rate is recommended for other safety trips. Elimination of several safety inputs, installation of a high pressure safety trip, and the relaxation of some setpoints are recommended. On the basis of operating experience to date and the results of this analysis, installation of the graded protective system did not appear to be justified. The analysis indicated that the present rod rates available to the controller are adequate and safe. Comparison between computer results and actual Savannah testing results indicates that the analog simulation is reliable for transient studies. (auth)

9831 (BNL-6062) ELECTRON MICROSCOPY OF FISSION FRAGMENT DAMAGE IN ALUMINUM–URANIUM FUEL ELEMENT. J. J. Kelsch and O. F. Kammerer (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract [AT(30-2)-Gen-16]. 4p.

An electron micrograph was made on an irradiated BNL Graphite Reactor fuel element core. The core was cold-rolled and electrolytically thinned before irradiation to 2.8×10^{15} nvt. The micrograph shows large numbers of light-colored straight tracks, most of which emanate from the dark round areas which are probably UAl_4 in Al matrix. (D.L.C.)

9832 (CEA-2200) LA PROTECTION CONTRE LES RADIATIONS A L'EMPILEMENT EXPERIMENTAL "MARIUS." (Radiation Protection in the Experimental Pile "Marius"). G. Coheny (France. Commissariat à l'Energie Atomique. Centre de Production de Plutonium de Marcoule, Chuscian). 1962. 18p.

Measurements made around the experimental pile "Marius" made it possible to determine the valid characteristics of the slabs designed to improve the biological protection by covering the charge and discharge pits. These measurements also made it possible to evaluate the risks occurring when the pile is operating at various powers and to make a reasonable estimate of the value of the ratio of the total danger due to neutrons (thermal and fast) and γ radiation and to the danger due only to the γ radiation. A knowledge of this ratio makes it possible to make satisfactory evaluations with a single apparatus which is really portative. (auth)

9833 (CEA-2205) PRESENCE DE TRITIUM DANS LES CIRCUITS DE REFROIDISSEMENT DES REACTEURS G2 ET G3. (Presence of Tritium in the Cooling Circuits of the Reactors G2 and G3). R. Estournel (France. Commissariat à l'Energie Atomique. Centre de Production de Plutonium de Marcoule, Chuscian). 1962. 8p.

In a reactor of the G 2–G 3 type, tritium can be formed by the neutronic bombardment of many elements present in the core. Tritium was found to be present in the cooling circuits of the reactors G 2 and G 3 in the water coming from the regeneration of the CO_2 dehydrating columns. (auth)

9834 (CEA-BIB-19) LES DISPOSITIFS DE SECURITE DU TYPE "FUSIBLE" DANS LE CONTROLE DU FONCTIONNEMENT DES PILES ATOMIQUES. (Safety Fuse Devices for the Control of Reactors). B. Bornand (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). 1962. 39p.

A survey of studies relative to a compact, independent, self-actuated safety device is presented. About 75 abstracts of publications issued from 1953 to 1961 are included. Most of these are from reports related to A.E.C. research projects. (auth)

9835 (CEND-121) STUDIES ON LOW ENRICHED CORES CONTAINING SIMPLE NUCLEAR SUPERHEAT ELEMENTS. PART I. CRITICAL EXPERIMENTS. J. S. Crudele, C. O. Dechand, P. G. Klann, and W. B. Wright, Jr. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Feb. 1, 1961. Contract AT(11-1)-795. 38p.

Activities in investigations to better understand the physics of Integral Nuclear Superheat Reactors are reported. Criticality measurements on clean arrays of rod-type elements (at partial water height) of the power distribution, lattice parameters, and reactivity coefficients at two water/UO_2 ratios and in a two-region (Boiler-Superheater) array were made. The experimental methods are discussed and results are included. (J.R.D.)

9836 (CVNA-133) PHYSICS PROPERTIES OF CLUSTERED UO_2–D_2O LATTICES AT VARIOUS LATTICE PITCHES. J. Jedruch, J. D. Cleary, R. D. Leamer, and J. A. Roll (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Oct. 1962. For Carolinas Virginia Nuclear Power Associates, Inc., Columbia, S. C. Contract [AT(30-1)-2289]. 344p.

An experimental and an analytic investigation of the effects of changes in the lattice of a core consisting of slightly enriched UO_2 rod clusters moderated by D_2O is described. Quantities related to thermal utilization and resonance escape probability are obtained for different water-to-U volume ratios. Thermal spectrum and conversion ratios are investigated by integral experiments. Critical masses and bucklings are given for different lattice pitches as well as spatial and total void coefficients. An optimum computational model is selected which gives good agreement with experimental values of selected parameters. (auth)

9837 (CVNA-144) IMPULSE BURST TESTING ON ZIRCALOY-4 PRESSURE TUBE. Topical Report. E. A. Davis and G. H. Eng (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). June 1962. For Carolinas Virginia Nuclear Power Associates, Inc., Columbia, S. C. Contract AT(30-1)-2289. 101p.

A test machine was designed and developed to perform impulsive-internal pressure tests on annealed and as-extruded Zircaloy-4 pressure tubes. The tests are simulated to the type of sudden loading encountered in reactor systems, such as "water hammer" conditions during slamming of a check valve. Repeated pressure pulses of constant energy, in addition to a steady pressure, were applied to the specimen until rupture occurred. The effect of longitudinal notches was studied at room temperature and at 275°F. The effect of hydrogen embrittlement on Zircaloy-4 could not be conclusively evaluated because of difficulties in the hydrogenation process. Conclusions are given on maximum safe loading and the effects of wall malformations and defects. (auth)

9838 (DP-784) A COMPUTER PROGRAM FOR FUEL ASSEMBLY DESIGN. James C. Jensen (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Oct. 1962. Contract AT(07-2)-1. 88p.

A FORTRAN computer program for the IBM 704 is described that designs fuel assemblies for a heavy water reactor. The assemblies consist of nested fuel tubes that are cooled by forced convection of heavy water. (auth)

9839 (EURAEC-406) STATISTICAL METHODS FOR HOT CHANNEL AND HOT SPOT CALCULATION. Quarterly Progress Report, April 1, 1962 to June 30, 1962. (FIAT. Sezione Energia Nucleare, Turin). July 31, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 035-60-11RDI. (FN-E-27)

An improved version of the Monte Carlo thermal hydraulic code, SHOC, that evaluates the correction factors rela-

tive to a PWR or a BWR reactor core according to a spot model was developed. This code, HYTHEST, uses a more refined and complete thermal and hydraulic model. The library was enlarged to permit calculation of different pressure conditions. A general work of comparison was programed in order to evaluate the behavior of the correction factors with variation of conditions such as geometrical and material tolerances, shape of axial neutron flux in reactor channel, and variation of operating conditions. (M.C.G.)

9840 (EURAEC-445) EVALUATION AND INTERPRETATION OF THE EXPERIMENTS ON ADIABATIC TWO-PHASE FLOW PERFORMED AT CISE UNDER THE CAN-1 PROGRAM. I. Casagrande, L. Cravarolo, A. Hassid, and M. Silvestri (Centro Informazioni Studi Esperienze, Milan). May 1962. Work Performed under United States–Euratom Joint Research and Development Program. 137p. (CISE-R-43)

Data obtained on adiabatic two-phase flow tests under simulated power reactor coolant channel conditions are presented. The quantities measured were pressure drop, liquid film thickness on walls, and flow rates in the conduit core. The density of the mixture and the oscillations of the static pressure were also investigated. Evaluations were made of the frictional pressure drop, film flow rates and entrainments, and phase and velocity distribution in the core. (J.R.D.)

9841 (EURAEC-492) FISSION GAS RELEASE FROM URANIUM DIOXIDE. Quarterly Progress Report No. 7, July–September 1962. (FIAT. Sezione Energia Nucleare, Turin). Oct. 31, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 011-60-9RDI. 19p. (FN-E-28)

A modification of the furnace design was adopted in order to obtain a more reliable experimental evidence of step releases from the UO_2 pellet samples. Experimental data obtained for three pellets and one swaged UO_2 sample are presented. The 6-hr test performed at 1730°C has shown a mechanism of fission gas release different from the diffusion-controlled release observed in previous experiments at lower temperatures in the range 1330 to 1565°C. A marked "cooling burst" has been observed in both the experiments performed at 1730°C. Micrographs are shown of the natural UO_2 pellet samples fabricated from powder. (R.J.S.)

9842 (GEAP-3481) COMPACT CONTROL ROD DRIVE STUDY FOR A BOILING WATER REACTOR IN A T7 TANKER. N. J. Biglieri (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Aug. 8, 1960. Contract AT(04-3)-189. 33p.

A compact drive study for the T7 tanker boiling-water reactor was undertaken to investigate control rod drive size, location, and removal space requirement factors and select the control rod drive mechanism which would allow optimization of the over-all size of the containment vessel. Of the control rod drive systems studied, the system which met the design criteria and provided the most compact containment vessel arrangement was a side-mouthed, bottom entry gear and rack control rod drive. It was determined that the rack assembly must be an integral part of the control rod position section. (M.C.G.)

9843 (GEAP-4013) ECONOMIC EVALUATION OF CONTROL ROD MATERIALS AND FABRICATION PROCESSES. H. E. Williamson and F. H. Megerth (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). May 1962. Contract AT(04-3)-189. 48p.

Control rod materials, designs, and fabrication processes were compared for their relative economics. Control rod lifetime data were calculated with a simple approximation of nuclear worth depreciation. These data were used in conjunction with the estimated fabrication costs to determine the cost of using several absorber materials in a typical power reactor on a cost-per-year basis. The effect the control system has on core power density and fuel lifetime was included. (auth)

9844 (GEAP-4026) IN-CORE INSTRUMENTATION DEVELOPMENT, FIRST TOPICAL REPORT, TASK II, PHASE I—TELEMETERING. A. C. Duckart (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Mar. 15, 1962. Contract AT(04-3)-189. 31p.

A telemetering system for in-core measurements is being developed, which will make it possible to transmit information from 100 or more in-core sensors through a single pressure vessel penetration. The development of a multiplexing subsystem for use within the reactor pressure vessel is being carried out. The most promising methods of multiplexing investigated are electromechanical commutation and electronic frequency division. (M.C.G.)

9845 (HW-74739) PHYSICS STATICS CALCULATIONS FOR A SERIES OF FAST SPECTRUM OXIDE REACTORS. P. L. Hofmann, G. J. Busselman, and R. J. Hennig (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 28, 1962. Contract AT(45-1)-1350. 14p.

Results of a brief study to obtain physics statics data for a series of fast spectrum, oxide-fueled reactors are presented. A model of a Na-cooled, steel-structured, oxide-fueled reactor is examined at power levels from 100 to 10,000 Mw. Calculation results concerning nuclear characteristics are included along with conclusions and recommendations. (J.R.D.)

9846 (HW-75568) REPORT ON CONTINUED EVALUATION AND TESTING OF PRTR FUEL ELEMENT RUPTURE DETECTION SYSTEM AND DEMONSTRATION DATA, APRIL 1, 1962–SEPTEMBER 1, 1962. J. E. Sisk (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 14, 1962. Contract AT(45-1)-1350. 18p.

Improvements made in the PRTR fuel element rupture detection system are described. The PRTR primary coolant is cycled through Zircaloy process tubes. For each process tube in the upper reactor access a sample tube is brought out to a heat exchanger. The coolant sample is reduced to 120°F and routed to the instrument cell containing the rupture detection system equipment. This equipment operates on a non-integrating principle where helium containing fission gases is released from the coolant and flows through a hold up chamber for gamma energy detection. Operating experience demonstration data are presented. (M.C.G.)

9847 (JPL-TR-32-217) ANALYSIS OF THE THERMAL DESIGN LIMITATIONS OF SOLID-CORE REACTORS FOR NUCLEAR PROPULSION. D. R. Bartz (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). Nov. 15, 1962. 44p.

An analysis of the thermal design limitations of gas-cooled solid-core nuclear reactors for rocket propulsion is presented. Closed-form integrated gas-dynamics equations coupled with variable-property heat-transfer equations are utilized to show qualitative relationships between important parameters. Numerical results from the equations are presented for designs in which H is used as the working fluid, for parallel-plate and parallel-hole core configurations. Of the two principal thermal design

limitations—pressure drop and thermal stress—the latter appears to be more important for conditions of practical interest. Originally published as a portion of a classified document in 1955, the numerical results are evaluated in terms of data available at that time on the thermal–physical properties of specific graphite types. It is shown that the results of the calculations–optimum core weights and volumes–are very sensitive to these properties. (auth)

9848 (KFK-108) NEUTRON SPECTRA IN HETEROGENEOUS ASSEMBLIES, A SUMMARY OF THE WORK OF THE KARLSRUHE GROUP. Wolf Haefele (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe). Apr./May 1962. 54p.

The influence of heterogeneity on neutron spectra in nuclear reactors and assemblies was investigated. The heterogeneous reactor model, a principal classification of neutron spectra, slowing down spectra in a plate-type reactor, equilibrium spectra in a plate-type reactor, reactor spectra in the thermal range, the representation of reactor spectra by simple sets of functions, and the iterated multigroup method are discussed. Graphs are included. (M.C.G.)

9849 (NAA-SR-7514) FLOWMETER SELECTION BASED ON METERING SECTION LENGTH. R. J. Begley (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Dec. 30, 1962. Contract AT (11-1)-Gen-8. 32p.

A method is presented for determining a differential-head-flowmeter design suitable for installations where insufficient pipe length is available to obtain maximum metering accuracy. Nomographic solutions are developed for design of optimum orifice and Venturi installations in which both accuracy and meter-run-piping lengths are specificed. A procedure for economic comparison of the optimum orifice and Venturi installation is given. Examples are presented of meter selection for sodium-cooled nuclear power reactor applications for which measurement of flow through large diameter pipes of short length is required. (auth)

9850 (NAA-SR-Memo-5794) EXTENDED TIME BOILING TEST NO. 6 CONDUCTED WITH OMRE COOLANT. J. L. Kortenhoeven (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Nov. 8, 1960. Contract [AT(11-1)-GEN-8]. 34p.

An investigation was conducted to demonstrate the feasibility of operating organic-cooled reactors for extended periods of time with irradiated coolant under conditions of nucleate boiling heat transfer (sub-cooled) at the fuel element surface. Test conditions and results are given and discussed. It is recommended that more knowledge be gained concerning the effect of coolant composition, surface conditions, and transient conditions on nucleate boiling heat transfer for organic coolants. (J.R.D.)

9851 (NYO-10474) SYSTEM STABILITY OF A SIMULATED BOILING WATER REACTOR WITH EXIT STEAM QUALITY CONTROL. Topical Report No. 6. Report No. 348. D. A. Gall, E. F. Doyle, P. D. Hansen, and R. D. Gustafson (Dynatech Corp., Cambridge Mass.). Nov. 1962. Contract AT(30-1)-2907. 43p.

An analytical model is proposed for the determination of the stability of the air-water simulation of a boiling water reactor with and without an exit quality control device. The comparison with experimental results is shown for both cases. (auth)

9852 (ORNL-3188) DESIGN REPORT FOR NMSR PRESSURIZED WATER LOOP AT ORR. I. T. Dudley, D. E. Tidwell, and D. B. Trauger (Oak Ridge National Lab., Tenn.). Jan. 5, 1962. Contract W-7405-eng-26. 66p.

A pressurized water loop constructed in the Oak Ridge Research Reactor for use in the Maritime Reactor Program is described. Irradiation testing of pressure vessel material specimens and several sets of fuel pins for the NS "Savannah" Nuclear Merchant Ship Reactor, NMSR, was completed. Operating conditions for the fuel tests nominally were 500°F and 1750 psig. The loop has capability for operation at 650°F, 2500 psig, with a maximum water flow rate of 80 gpm, and heat removal in excess of 150 kw. Design features include convenient access for insertion and removal of test specimens, efficient use of equipment cubicle space, and reliable operation. The loop is entirely constructed of 300-series stainless steel. A bypass purification and sampling system affords continuous water-chemistry control, and provision was made for attachment of special equipment for chemistry studies. Fuel and material test specimens are irradiated in the space provided by two tubes, 1.5 in. ID by 24 in. long, in positions A-1 and A-2 of the ORR core. The maximum unperturbed thermal-neutron flux is approximately 7.5×10^{13} neutrons/cm^2 · sec and the peak gamma heat about 5 w/g with the ORR operating at 30 Mw. (auth)

9853 (ORNL-TM-433) NEUTRON MULTIPLICATION BY EXPERIMENTAL GAS COOLED REACTOR FUEL ASSEMBLIES. E. B. Johnson and R. K. Reedy, Jr. (Oak Ridge National Lab., Tenn.). Nov. 27, 1962. Contract [W-7405-eng-26]. 6p.

Experiments were conducted to determine the source neutron multiplication of EGCR fuel assemblies under conditions which might exist in transportation and storage. Twenty-eight fuel assemblies were arranged to yield maximum nuclear reactivity under conditions which might be expected for out-of-reactor environments. It was found that these 28 assemblies cannot be made critical when water moderated and reflected. (auth)

9854 (RISÖ-47) ANALOGUE RESCALING INTEGRATORS AND THEIR USE FOR WIDE RANGE REACTOR SIMULATION. K. Soee Hoejberg (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Aug. 1962. 10p.

A description is given of two simple circuits for rescaling of normal analog computer integrators, and an example is given of reactor start-up simulation on a standard analogue computer by means of one of the circuits. Rescaling is here defined as the change of an arbitrary voltage with a certain factor on an integrator output. The purpose of rescaling is to enlarge the normal working range of an analogue integrator. (auth)

9855 (TID-13139) REACTOR TEMPERATURE. C. B. Mills (Los Alamos Scientific Lab., N. Mex.). [1961]. 17p. (LADC-4938)

Beryllium oxide and graphite critical experiments operated in the temperature range 90° to 1200°F were analyzed with a simple gas model neutron scattering matrix. A comparison of room temperature and high temperature experiments showed no systematic trends clearly ascribable to the method of calculation. It was concluded that in this temperature range the gas model is sufficiently accurate for the analysis of this reactor type for the epithermal to intermediate flux spectra found here. (auth)

9856 (TID-14537) DELAYED NEUTRON ECONOMY AND CONTROL IN A DIRECT CONTACT CORE LIQUID METAL FUELED REACTOR. Richard M. Bidwell (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 21p. (LADC-5159)

Losses of delayed neutron precursors are estimated for

liquid-metal-fueled reactor models in which the coolant is in direct contact with the flowing fuel. It is shown that as much as 90% of the precursors may be extracted by the coolant before decaying to supply neutrons. As a result, the excess reactivity corresponding to prompt critical can decrease by a factor of 10, leading to a considerable shortening of the reactor period corresponding to a given Δk. These conditions will, in actual operation at power, be alleviated by the contribution of blanket-delayed neutrons and by the large negative temperature coefficient characteristic of liquid systems. The effects of mixing and reduced flow on delayed neutron economy and resulting reactor period are evaluated. The benefits of reducing the flow are shown to be by far the greater, and a slower flow is recommended if enhanced control through delayed neutrons is needed at start-up. (auth)

9857 (TID-17391) THE USE OF SUBCRITICAL ASSEMBLIES FOR STUDYING REACTOR PARAMETERS. D[avid] R. Bach (Knolls Atomic Power Lab., Schenectady, N. Y.). [Oct. 27, 1962]. Contract [W-31-109-eng-52]. 30p.

The determination of diffusion parameters in diffusing media in far-subcritical assemblies by the pulsed neutron technique is discussed. The theory developed for the calculation of decay constants in subcritical systems is outlined. The critical and subcritical assemblies used are described. Data obtained for a moderating slab of polyethylene are presented and analyzed. It is shown that measurements of the fundamental mode prompt neutron decay constant can be performed successfully on assemblies whose reactivity ranges from critical to far-subcritical, provided that subcriticality is achieved by decreasing the size from critical size, rather than by addition of poison to the critical size assembly. (M.C.G.)

9858 (TID-17395) ON-LINE DATA REDUCTION BY ANALOG COMPUTERS. J. E. Barnes and I. W. Underwood (Knolls Atomic Power Lab., Schenectady, N. Y.). [nd]. Contract [W-31-109-eng-52]. 9p.

The use of analog computers in reduction of data at test sites and experimental facilities for the immediate use of engineers is discussed. An example of use in the Transient Reactivity Meter is described. The meter computes the reactivity of the reactor in an operating power plant. The theory of operation and uses are discussed. (M.C.G.)

9859 (TID-17473) PROGRAMMING THE GENERALIZED ONE DIMENSIONAL DIFFUSION EQUATION SPACE SIMULATOR AND SIMULATION OF THE SHIPPINGPORT PRESSURIZED WATER REACTOR (thesis). James Conda Robinson (Tennessee. Univ., Knoxville). Aug. 1961. 93p.

A general program for the solution of nuclear diffusion equations was developed for the GODDESS computer and applied to the Shippingport Pressurized Water Reactor. The two-group diffusion equations, and the derivation of the difference equations for rectangular, cylindrical, and spherical coordinates are discussed. The analog computer is described. The criticality criteria are presented along with a method to assure that the voltage distribution appearing at the various meshpoints represent the flux distribution which would be present in the simulated reactor. The simulation of various boundary conditions which are normally imposed on the diffusion equations is discussed. The principles involved in attaining the required nuclear coefficients for simulation of the Shippingport Pressurized Water Reactor are presented. (M.C.G.)

9860 (TID-17655) INTEGRATED POWER FUEL PROCESSING. Fred H. Tingey (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). [nd]. Contract [AT(10-1)-205]. 16p.

Costs for processing spent fuels of the MTR type are discussed. It is shown that pooling of residual fuel by several reactor operators for processing would result in economic advantages. Examples are given. (M.C.G.)

9861 (TID-17658) STOICHIOMETRIC AND RESIDUAL MASS DISTRIBUTION MEASUREMENT PROCEDURES FOR DETERMINING BURNUP. F. H. Tingey (Phillips Petroleum Co., Idaho Falls, Idaho). [nd]. Contract [AT(10-1)-205]. 3p.

Methods for analysis of dissolver solutions of highly enriched U fuel are proposed. In the use of the methods it is assumed that a valid value has already been obtained on the unirradiated U content. The advantage of the procedures lies in the fact that the weighted mass distribution of a segment of processed fuel even under a batch process is essentially insensitive to small tank volume biases and unaffected by either plating or evaporation in the sample bottle. Results obtained by the proposed methods are presented along with results obtained by the usual chemical determinations for several reactor cores. (J.R.D.)

9862 (UNC-5008-II) INVESTIGATION OF WET STEAM AS A REACTOR COOLANT (CAN-2). VOLUME II. CONCEPTUAL DESIGN EVALUATION OF A FOG-COOLED LIGHT WATER REACTOR. Final Report. M. Raber, G. Sofer, F. Nakache, and A. Weinstein (United Nuclear Corp. Development Div., White Plains, N. Y.). Aug. 10, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2828. 123p. (NYO-9844-II; EURAEC-502)

The conceptual design of a fog-cooled light water-moderated reactor using quality at inlet was re-evaluated with particular emphasis on the influence of coolant density changes on reactivity at startup and shutdown. Although this design calls for steam recirculation equipment, it offers cost advantages over dual cycle boiling water reactors, such as Dresden and SENN by virtue of a lower steam void coefficient, which permits the use of a single direct cycle. When compared to more advanced boiling waters using a single direct cycle, the fog-cooled plant using quality inlet is not expected to be competitive. An alternate design, using saturated or slightly subcooled water at core inlet and mass velocities sufficiently high to yield fog flow conditions over a large portion of the coolant channels, promises to result in cost savings over single direct-cycle boiling water reactors of 0.15–0.30 mills/kwh. These savings are the result of improved voiding characteristics, permitting higher exit qualities and reduced water recirculation rates. (auth)

9863 (WAPD-T-1534) SPACE AND TIME SYNTHESIS BY THE VARIATIONAL METHOD. S. Kaplan (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1962. Contract AT(11-1)-Gen-14. 29p.

Approximation methods being developed for the solution of few-group diffusion equations for core designs requiring solutions to large-size problems are described. These methods use the process of synthesis by constructing approximate solutions to multi-dimensional problems out of solutions to fewer dimensional problems. Both space and time synthesis by the variational method are described. (M.C.G.)

9864 (EURAEC-401) AN ADVANCED RESEARCH PROGRAM ON THE APPLICATION OF STEAM-WATER SPRAY TO THE COOLING OF LIGHT WATER REACTORS. CAN-2 Quarterly Progress Report No. 4, April 1–June 30,

1962. (Centro Informazioni Studi Esperienze, Milan). July 27, 1962. Work Performed under United States–Euratom Joint Research and Development Program Contract 060-61-7-RDI. 13p. Translation of CISE-R-60.

Experiments were performed to measure the burnout heat flux in tubular test elements having an unheated portion inserted between two identical heated portions. The length of the heated portions was held constant in the different experiments, while the length of the unheated portion was varied. These experiments showed that, at least in the investigated range, the total power that can be extracted from a test element depends on the total length only and not on the power distribution along the axis. A series of experiments was also started in order to determine critical heat fluxes in very long and very short heated channels. The new high-pressure Ar loop was tested. Single phase (gas) experiments were performed in order to check the reliability of the data obtained by means of the isokinetic probe. The pressure-drop measurement system was also checked. Work is in progress in order to improve the device for measuring the shear stress on the duct wall and the beta-ray absorption method for density measurements. Two loops are presently in operation, both for Zircaloy-2 corrosion tests. In the first one, exposure tests of more than 4000 hr are in progress, while the second is used for investigating the influence on corrosion of a given oxygen content in water. (auth)

9865 AN ADVANCED GAS-COOLED SMALL REACTOR. W. Junkermann and E. Boehm (Deutsche Babcock and Wilcox-Dampfkessel-Werke A. G., Oberhausen, Ger.). Atomkernenergie, 7: 450-6(Dec. 1962). (In German)

The development of a small reactor plant having an advanced gas-cooled graphite-moderated reactor is being carried out. The design principles and tasks of this reactor as well as some basic development and research work are described. (auth)

9866 THE NATURAL WATER CIRCULATION OF A NAVAL BOILING WATER REACTOR UNDER THE INFLUENCE OF LISTING. Nikos Christodulu (Technische Hochschule, Hanover). Atomkernenergie, 7: 477-80(Dec. 1962). (In German)

The motion of a ship has great influence on the general attitude of a boiling water reactor using natural circulation of the coolant. Because of this the steam volume fraction and the reactivity are variable. The natural circulation in the core of a boiling water reactor while the ship is listing was considered. Forms to calculate the circulation are given. (auth)

9867 REACTIVITY MEASUREMENT AND XENON CALCULATOR. M. Deiss. Bull. Inform. Sci. Tech. (Paris), No. 61, 46-50(May 1962). (In French)

A precise direct and rapid determination of the evolution of reactor power can be deduced from the measurement of the real reactivity ρ, almost comparable to a multiplication coefficient exceeding δk. The principle of the measurement of a multiplication coefficient exceeding δk is described, and the construction and design of an instrument to measure this parameter are given. The design and performance of an instrument for the instantaneous measurement of the evolution of xenon poisoning is also discussed. (J.S.R.)

9868 SYNCHRONOUS RELUCTANCE MOTORS FOR THE TELECONTROL OF CONTROL RODS. P. Jover. Bull. Inform. Sci. Tech. (Paris), No. 61, 51-7(May 1962). (In French)

The principle of telecontrol by reluctance motors and the characteristics of such motors are briefly reviewed. A telecontrol unit for operating control rods is described in principle and operation. (J.S.R.)

9869 RECENT SOLUTIONS TO THE PROBLEMS OF DETECTION OF CLADDING RUPTURES. P. Desneiges and A. Roguin. Bull. Inform. Sci. Tech. (Paris), No. 61, 58-67(May 1962). (In French)

The methods used for the detection of cladding ruptures in water-cooled and gas-cooled reactors are briefly summarized. Then the detection systems used in the G-1 and EL-2 reactors are described. It is shown how the complexity of such a system is dependent on the number of reactor channels and on the evolution of the cladding ruptures. The pneumatic and associated electronic circuits of the detection system are summarized. (J.S.R.)

9870 DATA PROCESSING IN NUCLEAR REACTORS. J. Megy, A. Chapelot, J. P. Satre, and J. Tranchant. Bull. Inform. Sci. Tech. (Paris), No. 9: 61, 68-95(May 1962). (In French)

The industrial evolution of data processing and the use of these new techniques in nuclear reactors are briefly summarized. Data processing devices at the G-2, G-3, Pegase, Cabri, and rupture detection installation of the EDF reactors are described as illustration of this evolution. (J.S.R.)

9871 CONTRIBUTION OF ANALOG CALCULATION TO REACTOR CONTROL PROBLEMS. Claude Caillet. Bull. Inform. Sci. Tech. (Paris), No. 61, 102-10(May 1962). (In French)

A brief survey is given of the contribution of analog calculation to reactor control problems, with a consideration of the basic principle of analog calculation, the analog calculation means at Saclay, operational methods, and dynamics of reactors and their control. An attached bibliography compiles the analog studies made at Saclay on reactor control. (J.S.R.)

9872 MEASUREMENT OF VERY LOW REACTIVITIES BY PSEUDO-ALEATORY EXCITATION OF THE SOURCE. T. E. Stern. J. Valat, and J. Cazemajou. Bull. Inform. Sci. Tech. (Paris), No. 61, 123-31(May 1962). (In French)

A method for the measurement of very low reactivities is proposed utilizing a fast neutron (14-Mev) source, modulated electronically by a pseudo-aleatory wave of the white-background type. The reactivity is estimated by examining the pulse response of the reactor, this pulse response being measured by intercorrelation between the input (source intensity) and the output (neutron population). The theory of the determination of the reactivity of the pulse response and of the pulse response by intercorrelation is discussed. Then the experimental determination of the intercorrelation function is given. The theory, design, and construction of a pseudo-aleatory square-wave generator with binary counter-reaction displacement registration is given. (J.S.R.)

9873 STUDIES ON THE SAFETY OF REACTORS. J. Bourgeois. Bull. Inform. Sci. Tech. (Paris), No. 63, 4-8(July 1962). (In French)

The history of safety studies is briefly outlined and their economic interest in nuclear energy is indicated. The research programs devoted to reactor safety at present under way in the United States and Great Britain are reviewed. The main points of the French research program are discussed. (auth)

9874 SAFETY ENVELOPES FOR NUCLEAR REACTORS. R. Mattera. Bull. Inform. Sci. Tech. (Paris), No. 63, 49-75(July 1962). (In French)

This paper is the text of a lecture replying to two ques-

tions: Why are nuclear reactors enclosed in a container sealed from contact with the outside air? What are the characteristics of this container and what norms are followed in its construction? The problems which arise and which have not yet all been solved in this area are outlined, as for example the resistance of the envelopes to shock waves, the possibility of chemical reactions during a runaway burst of nuclear power, etc. (auth)

9875 EMISSION OF FISSION PRODUCTS BY FUSED METAL OR OXIDE NUCLEAR FUELS. M. Laffaire and J.-M. Lavie. Bull. Inform. Sci. Tech. (Paris), No. 63, 83-95(July 1962). (In French)

The present position with respect to knowledge of the question of fission product emission from fused fuels is stated. The various factors influencing this phenomenon are briefly reviewed: nature of the fuel, running temperature, and cooling fluid. The laws which govern this emission are difficult to formulate and depend on too many unknown factors. An attempt has been made to give the percentages admissible according to specialists on the subject. A final paragraph is devoted to the aims of the national programs being followed up, so far as this is known. (auth)

9876 SAFETY IN THE CONTROL OF ATOMIC REACTORS. J. Furet. Bull. Inform. Sci. Tech. (Paris), No. 63, 113-27(July 1962). (In French)

The aspects of reactor safety in connection with control systems are reviewed: the influence of reactivity, controls in the starting-up phase, shutting down control, influence of delays due to the security system in cases of reactivity and cooling accidents, etc. The principles adopted for the neutronic security of reactors are set out, and the present characteristics of the safety equipment used are described. (auth)

9877 PLANT FOR PROCESSING UO_2-ThO_2 FUEL ELEMENTS. Alberto Pedretti (Comitato Nazionale Energia Nucleare, [Rome]). Comit. Naz. Energia Nucl., Notiziario, 8: No. 5, 16-29(May 1962). (RT/ING(62)6). (In Italian)

Construction of a plant for reprocessing and refabricating burnt-up fuel elements is planned. The cost of the plant is estimated to slightly exceed 2 billion lire. It was designed to process and refabricate uranium oxide and thorium oxide fuel elements of the ceramic type, canned in stainless steel, coming from the first loading of the Elk River Reactor in the U.S.A. The design, construction, and operation of the plant are part of a program aimed at demonstrating the greater economy achieved with the U-Th cycle, as compared to the U-Pu cycle. (R.J.S.)

9878 MODERN ASPECTS OF NUCLEAR REACTOR THEORY. Vinicio C. Boffi and Vincenzo G. Molinari. Comit. Nazl. Energia Nucl., Notiziario, 8: No. 12, 47-56 (Dec. 1962). (In Italian)

The transport and thermalization of neutrons constitute two problems of great current importance for the design of a nuclear reactor core and for a better understanding of the phenomena that determine the spectral distribution of neutrons inside the core. (auth)

9879 APPLICATION OF THE RELAXATION METHOD TO THE STUDY OF THE THERMAL REGIME OF A NUCLEAR REACTOR. Luciano Biasini (Centro di Calcolo, Bologna) and Roberto Evangelisti. Comit. Nazl. Energia Nucl., Notiziario, 8: No. 12, 67-75(Dec. 1962). (In Italian)

Studies were made on a method for the numerical integration of the differential equation, $a(x,y) \cdot [U_{xx} + U_{yy}] + P(x,y) = O$, in a plane domain whose boundary consists of three straight lines and one arc of circle. The usefulness of this method in the study of the thermal regime of a nuclear reactor is shown. (auth)

9880 BOILING REACTOR—THE PERSPECTIVE DEVICE IN NUCLEAR POWER PLANTS. V. E. Doroshchuk and Yu. N. Makarov. Elektr. St., 33: No. 4, 11-14 (1962). (In Russian)

An increase of the power level of boiling water reactors to a sufficiently high value results in excessive heat transfer losses caused by friction, inhibiting the circulation of the heat transfer agent and resulting in instabilities in the liquid flow. However, the power fluctuations which may reach as much as 20% when the heat transfer agent is at atmospheric pressure, decrease sharply at higher pressures. Increase of the loading also increases the amplitude and the frequency of the power oscillations but this again is counteracted by increasing the pressure. At a given, usually high power level, the so-called resonance instability may arise, observed by a sudden rise of the amplitude of the oscillations. Good results were obtained at the Argonne National Laboratory with the BWR: the reactor designed for 42 Mw, operated in a stable manner at pressures up to 62 when tested at elevated pressures; the fluctuations did not exceed 2%. The secondary circuit controls, the system which is thus self-regulating. The steps taken with the BWR for keeping the steam free from fission products were quite successful: the activity of the internal surface of the turbines reached only 5 mr/hr, thus being below the maximum permissible level. Superheating the steam, especially nuclear superheat, represents an excellent method to increasing the efficiency of the boiling water reactor systems. (TTT)

9881 THE BEHAVIOUR OF IODINE RELEASED IN REACTOR CONTAINERS. W. J. Megaw and F. G. May (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Energy, Pts. A & B, 16: 427-36(Sept. 1962).

Experiments are described in which iodine-127 and iodine-132 tracer was released as elemental iodine vapor in the DIDO and PLUTO reactor shells to give concentrations in the range 0·01 to 15 $\mu g/m^3$, and the behavior of the iodine studied over a period of several hours. It was found that most of the iodine disappeared rapidly by deposition on surfaces in the reactor shell and that of the remainder which remained airborne for periods of several hours, part became attached to sub-micron particles in the atmosphere and part appeared to form two iodine compounds. It was found that the release of iodine-127 to the reactor atmosphere could cause the return to the gas phase of radioactive iodine previously deposited on surfaces in the reactor containment vessel. It is suggested that this, in conjunction with an iodine vapor scrubber, may provide an effective method of decontaminating reactor vessels after a release of radioactive iodine. (auth)

9882 SUBCRITICAL REACTIVITY MEASUREMENT BY A SOURCE-JERK METHOD. T. B. Ryves (National Physical Lab., Teddington, Middx., Eng.) and M. C. Scott. J. Nucl. Energy, Pts. A & B, 16: 455-63(Sept. 1962).

The theory of the source-jerk technique for the measurement of subcritical reactivity was refined to take account of harmonics present in the neutron flux distribution. The method was applied to the measurement of the subcritical activity in a large graphite-moderated uranium-fueled reactor. The subcritical reactivity was found to be $[-2.63 \pm 0.21]$ per cent $\Delta K/K$. This value is about 10 per cent higher than estimates based on the subcritical approach to critical and on the measured interaction of shut-off rods. (auth)

9883 BURN-UP AND LIFETIME OF ABSORBER ELEMENTS. [PART] II. B. Koehler (VEB Entwicklung and Projektierung Kerntechnischer Anlagen, Berlin). Kernenergie, 5: 606-10(Aug. 1962). (In German)

In the second part of the description of a method for the calculation of the neutron physical lifetime of absorber materials, the maximum lifetime of various absorbers is calculated. Economic comparisons for various materials are considered. (J.S.R.)

9884 PRESENT STATUS AND PROSPECTS OF USING ORGANIC COMPOUNDS AS MODERATOR-HEAT CONDUCTORS IN ATOMIC REACTORS. Man-wei Chang. K'o Hsueh T'ung Pao, No. 12, 16-21(1961).

Discussion is given on the use of organic compounds as moderator-heat conductors in nuclear reactors. The advantages of organic compounds over water are listed. However, organic compounds are harder to purify, have higher fusing points, are lower than water in heat exchange, and are vulnerable to destruction. Thus far tri-xenene mixtures have proved best for moderator-heat conductors. A review on previous works by others on moderator-heat conductor systems is also included. (P.C.H.)

9885 THE REPRESENTATION OF A ONE-DIMENSIONAL MODEL OF A NUCLEAR REACTOR ON AN ANALOGUE COMPUTER. [PART] I. W. G. Proctor and B. Wilson (United Kingdom Atomic Energy Authority, Risley, Eng.). Nucl. Power, 8: No. 81, 56-9 (Jan. 1963).

A one-dimensional reactor model is described that can handle axial spatial variations; the model is composed of a set of radially averaged equations programmed for an analog computer. The means used to include effects of heat transfer, poisoning, fission-product heating, and neutron behavior in the model are described. The use of the model to determine the flux shape in the reactor is discussed. An outline of the computer program is included. (T.F.H.)

9886 LARGE REACTORS MAY DISTILL SEA WATER ECONOMICALLY. R. Philip Hammond (Los Alamos Scientific Lab., N. Mex.). Nucleonics, 20: 45-9(Dec. 1962).

Nuclear reactors in very large sizes hold out the promise of large-scale distillation of fresh water from the sea at a cost low enough for municipal, industrial, and irrigation uses. According to the results of a preliminary study, water in these cost ranges can be produced by breeder-reactor distilling plants if they can be built large enough—up to 100,000 Mwth. The cost of water depends strongly on the size of the unit; for larger plant sizes, costs below $15¢/10^3$ gal may be possible. (R.J.S.)

9887 USING PLUTONIUM IN THERMAL REACTORS. Eugene A. Eschbach and Stanley Goldsmith (General Electric Co., Richland, Wash.). Nucleonics, 21: No. 1, 48-52 (Jan. 1963). (HW-SA-2831)

Comparisons of Pu^{239} and U^{235} as fuels for thermal reactors must consider all the plutonium isotopes as well as data uncertainties. Pu^{240} can be effective as a burnable poison and valuable as a fertile material. (auth)

9888 CALCULATION OF NEUTRON DENSITY DISTRIBUTION IN THE REFLECTED REACTOR BY THE FERMI AGE THEORY. A. A. Kostritsa and V. D. Kubyshkina. Tr. Kazakhsk. Univ., No. 2, 83-90(1960).

The age-diffusion theory was used to determine the effective multiplying factors, spatial distributions of thermal neutrons, and neutron moderation densities in reflected reactors. The age of thermal neutrons was assumed to be the same in both zones. The thermal neutron diffusion equation and the Fermi age equation for moderated neutrons were solved by a numerical method of successive approximations using two integrators simulating neutron diffusion and moderation. Calculation results on slab reactors of three different types were compared using the age-diffusion and two-group theory. For the first-type finite-cylinder reflected reactor on enriched fuel, the two methods yield markedly different thermal neutron distributions. The difference is small in infinite-cylinder reflected reactors on slightly enriched fuel. Both the age and the two-group method yielded one and the same multiplying factor value (within the integrator accuracy) for reactors of all three types. (Referativnny zhurnal, Fizika, 51: No. 2, 1962.)

9889 THE INSULATION OF ORGANIC-COOLED REACTOR PRESSURE TUBES USING THE FLOWING COOLANT AS AN INSULANT. James T. Rogers (Canadian General Electric Co., Ltd., [Toronto]). AIChE Preprint 130. New York, American Institute of Chemical Engineers, 1962. Prepublication Copy. 32p. $0.50.

One method of insulating the fuel channels in an organic-cooled, heavy-water-moderated, pressure-tube reactor is to utilize a small fraction of the organic coolant itself flowing in parallel to the fuel channel flow in a narrow annulus between the pressure tube and a liner which forms the outer boundary of the fuel channel. Preliminary work produced an annulus configuration which provides good insulation effectiveness and low coolant residence time in the core and which gives promise of meeting other design requirements of neutron economy and mechanical reliability and simplicity. The chosen annulus configuration has an inner wall of widely spaced circumferential rings with very narrow gaps between the rings and the outer wall of the annulus. The rings restrict the annulus flow to the laminar regime and the resulting annulus Nusselt numbers are lower than 2.0 at representative reactor core pressure drops. An analytical method is developed which gives good agreement with the experimental results. The work shows the effect of ring pitch on annulus conductance and shows that the narrow ring clearance gaps generally do not close up completely under operating conditions even when interference between rings and pressure tube is predicted. Annulus flow instability can occur under certain conditions. Finally, remaining problems to be solved are listed. (auth)

9890 CONSTRUCTING LOW-LEAKAGE REACTOR HOUSING USING CONVENTIONAL MATERIALS. R. L. Koontz, C. T. Nelson, and S. E. Becker (Atomics International, Canoga Park, Calif.). ASME Preprint Paper No. 62-WA-203. New York, American Society of Mechanical Engineers, 1962. 7p. $1.00.

Air leak-rate measurement data on components used in conventional building construction are presented along with empirical equations for predicting the leak rate of large reactor housing installations. In addition, precautions to be observed in constructing such installations are noted. (auth)

9891 STUDY OF REACTOR KINETICS. A. Stanley Thompson (Varna Corp., Danville, Calif.). ASME Preprint Paper No. 62-WA-218. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 12p. $1.00.

A non-linear differential equation for the transient behavior of nuclear reactors is developed. The solution to the differential equation shows resonant modes of vibration as a result of the coupling of mechanical and thermodynamic effects with neutronic effects. Whether these resonant vi-

brations are damped, periodically repeated, or divergent depends on the values of two primary ratios, one being the ratio of the neutronic to the mechanical frequency, the other the ratio of the neutronic damping to mechanical damping. For certain combinations of reactor characteristics, it is impossible to avoid divergent instabilities in reactor power. This analysis displays these regions of instability in a form that may provide a basis for tailoring the design of reactors for stable operation. The analysis is developed from general nuclear, mechanical, and thermodynamic considerations, and in its general form, is applicable to all nuclear reactors. (A.G.W.)

9892 THE REMOVAL OF NEUTRON POISONS, IN PARTICULAR ^{135}Xe AND ^{135}I, FROM AN AQUEOUS HOMOGENEOUS SUSPENSION REACTOR. Pieter Job Kreiger. Thesis, Delft, Technische Hogeschool, 1962. 132p.

The removal of volatile and nonvolatile water-soluble and water-insoluble poisons from both the aqueous and steam phases of the heavy water system of an aqueous homogeneous one-region reactor is studied. Particular attention is devoted to the removal of $I^{135}-Xe^{135}$, but the removal of erosion and corrosion products, Sm^{149}, and other fission products is also considered. The reactor is considered to be fueled with ThO_2-UO_2 particles. (T.F.H.)

9893 ASYMMETRICAL THERMAL STRESS DISTRIBUTION IN REACTOR FUEL TUBES. LaMar I. Deverall (United Tech. Corp., Sunnyvale, Calif.). Preprint Paper No. 62-WA-235. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 25-30, 1962.

A theoretical analysis is presented of the thermal stress developed in a reactor fuel tube which has uniform internal power generation, but which has convective heat transfer at the outer surface such that an unsymmetrical temperature distribution is developed. This type of problem can occur in the design of a high-temperature gas-cooled reactor such as those contemplated for nuclear ramjet and rocket-propulsion use. The temperature and stress distributions for a typical fuel tube are given in detail. The method of analysis which is developed is also applicable to other reactor problems such as the thermal-stress analysis of pressure vessels and tubular flow channels. (auth)

9894 SITE REQUIREMENTS FOR LARGE NUCLEAR STATIONS. R. P. Schmitz and D. W. Halligan (Bechtel Corp., San Francisco). Preprint Paper No. 62-WA-333. New York, The American Society of Mechanical Engineers, 1962. 7p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 25-30, 1962.

The knowledge and experience accumulated in the siting of smaller single-unit nuclear stations is projected into the future when large multi-unit nuclear plants will be of interest in the United States. The siting requirements of large nuclear plants are discussed and alternative design features useful in siting considerations are presented and evaluated. (auth)

9895 TECHNIQUES OF ATOMIC REACTOR PLANT DECONTAMINATION. N. Michael (Astropower, Inc., Costa Mesa, Calif.), G. R. Taylor, and Paul Cohen. Preprint Paper No. 62-WA-290. New York, The American Society of Mechanical Engineers, 1962. 8p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 25-30, 1962.

The nature of radioactive contamination in pressurized-water atomic power plants and its extent in some typical operating plants are surveyed. Decontamination-solution requirements and decontamination procedures are then reviewed and some effective decontamination solutions are discussed. (auth)

9896 REACTOR SAFEGUARDS. Charles R. Russell. A Pergamon Press Book. International Series of Monographs on Nuclear Energy. Division XI: Reactor Operational Problems. Volume 1. New York, The MacMillan Company, 1962. 396p.

A study is made of reactor safety aspects associated with radioactive materials, reactor kinetics, control and safety systems, containment, extent of possible damage, siting requirements, operating experience, safety features of water reactors, and dispersion of radioactive materials. (T.F.H.)

9897 SIMULATION OF BEHAVIOR OF THE PRESSURIZER OF A REACTOR OF THE PRESSURIZED WATER TYPE. J. P. Contzen (Centre d'Etude de l'Energie Nucléaire, Mol, Belgium). p.347-55 of "Third International Analogue Computation Meetings, Opatija, Sept. 5-8, 1961." Brussels, Presses Académiques Européennes, 1962. (BLG-143). (In French)

A dynamic model is described for the simulation of the transient behavior of the pressurizer of a pressurized water reactor. This model is intended to be used mainly in the overall simulation of a reactor system rather than for the detailed study of the pressurizer considered alone. The model takes into account the existence of two phases—vapor and liquid—, the presence of a spray and heaters which act on condensation and flashing, and the influence of the vessel walls on condensation. The model considers superheating of the vapor during transients. (auth)

9898 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS. Robert Flinders Jackson and Graham Thomas Shears (to United Kingdom Atomic Energy Authority). British Patent 869,645. June 7, 1961. Filed Oct. 23, 1959.

A nuclear reactor fuel element comprising a fuel member enclosed in a protective sheath has within the sheath a device of lower melting point than the fuel member and of different material than the sheath. The device is so disposed that it undergoes noticeable change of shape on melting. The physical conditions to which the fuel element has been exposed may thus be assessed. (R.J.S.)

9899 IMPROVEMENTS IN OR RELATING TO DUCT SYSTEMS. Herbert Chilvers Knights (to United Kingdom Atomic Energy Authority). British Patent 910,827. Nov. 21, 1962. Filed May 25, 1960.

A duct system is described for conducting radioactive fluids through chambers occupied by operating personnel. The duct is confined within a radiation-shielding structure and monitoring means are provided for detection of leakage from the duct. (R.J.S.)

9900 IMPROVEMENTS IN OR RELATING TO DEVICES FOR UNLOADING RADIOACTIVE ELEMENTS FROM A VERTICAL DUCT OF A REACTOR CORE. Sebastien Foglia (to Commissariat à l'Energie Atomique). British Patent 910,843. Nov. 21, 1962. Priority date Feb. 18, 1959, France.

A device is designed for unloading damaged fuel elements, sheaths, or control rods from vertical channels in a reactor core. The device comprises a body with means at its upper end for coupling to a support and at its lower end at least three vertical fingers for lifting a damaged element. The fingers have recesses with locking balls adapted to

wedge between the element and the fingers to effect lifting of the element. (D.L.C.)

9901 IMPROVEMENTS IN AND RELATING TO SUPPORT STRUCTURES. Brian Vernon Gaskell (to General Electric Co. Ltd.). British Patent 910,902. Nov. 21, 1962. Filed Dec. 8, 1959.

A structure is described for supporting a body within a tubular carrier so as to permit flow between the body and the carrier. The structure is applicable to reactor fuel element support. (R.J.S.)

9902 IMPROVEMENTS IN THE PRECIPITATION OF DECAYED FISSION PRODUCTS FROM GASES. Frank Harlen (to Dowty Electrics Ltd.). British Patent 910,952. Nov. 21, 1962. Filed Oct. 3, 1957.

Decay products are precipitated on to an elongated conductor in a precipitation chamber. The activity of the deposit is determined by a detector through which the conductor is arranged to pass. Such equipment is normally employed to detect fuel element failure in gas-cooled nuclear reactors. (R.J.S.)

9903 STABILIZING SYSTEM FOR NUCLEAR REACTORS, PARTICULARLY THOSE OPERATING WITH BOILING WATER. (to Indatom, S.A.R.L., Bureau d'Etudes pour l'Energie Nucleaire). British Patent 911,132. Nov. 21, 1962. Priority date Dec. 3, 1958, France.

A control system for a boiling reactor is designed which increases the stabilized power at which the reactor may be operated. The control system comprises a neutron flux detector for producing a signal proportional to the reactor power, a correcting circuit having an increasing gain with frequency for producing an output which varies with the rate of change of the signal, and control rods movable by the output of the correcting circuit. The control rods are moved under control of a signal of the form $\delta k = -K(dP/dt)$, where δk = reactivity change, P = power, t = time, and K = a constant. (D.L.C.)

9904 IMPROVEMENTS IN OR RELATING TO ORGANIC LIQUID MODERATED AND COOLED NUCLEAR REACTOR. Ronald Peter Williams, Peter Neil Munn, and Thomas Richardson Duncan (to United Kingdom Atomic Energy Authority). British Patent 911,135. Nov. 21, 1962. Filed June 14, 1960.

A cylindrical upright pressure vessel has, in its lower regions, a shielding structure around and below a core structure. A heat exchanger in the upper regions is disposed about a hollow column extending downward to the core. Means are provided for circulating the liquid moderator and coolant. (R.J.S.)

9905 IMPROVEMENTS IN OR RELATING TO TRANSLATORY MOVEMENT CONTROL DEVICES. Gerard Dupuy (to Commissariat à l'Energie Atomique). British Patent 911,199. Nov. 21, 1962. Priority date July 18, 1960, France.

A control system for swimming-pool-type reactors is designed which allows rapid shutdown as well as compensations for large, slow and small, and rapid variations of reactivity. The system comprises a carriage for supporting a control rod and movable inside a guide tube with flexible walls, a movable member having rollers for engaging the carriage from outside the tube, and means for driving the movable member. For normal operation, electromagnets are energized to couple the movable member with the carriage, and for shutdown, the electromagnets are de-energized to allow the control rod to fall into the reactor core. (D.L.C.)

9906 IMPROVEMENTS IN OR RELATING TO RESTRAINT BANDS FOR GRAPHITE ASSEMBLIES OF NUCLEAR REACTORS. James Wilfred Ashley and Leslie James Knight (to Atomic Power Constructions Ltd.). British Patent 911,200. Nov. 21, 1962. Filed Feb. 18, 1958.

The restraint band is comprised of a series of links adapted to transmit the tensions in the band as a centripetal load to the external wall of the graphite structure. (R.J.S.)

9907 IMPROVEMENTS IN METHODS OF SHEATHING HOLLOW FUEL ELEMENTS FOR NUCLEAR REACTORS. (to Commissariat à l'Energie Atomique). British Patent 911,466. Nov. 28, 1962. Priority date May 13, 1959, France.

A method for sheathing the inner surface of hollow cylindrical fuel elements is described which keeps the fuel in intimate contact with the inner sheath. In this method, plastic or resilient deformation by the coolant gas is used to force the inner sheath into contact with the fuel. In the case of plastic deformation, the inner sheath is a thin cylindrical sheet, while in the case of resilient deformation, the inner sheath has three narrow lengthwise hollow fins formed by corrugation of the sheet. (D.L.C.)

9908 FUEL ELEMENT ARRANGEMENT FOR NUCLEAR REACTOR. (to U. S. Atomic Energy Commission). British Patent 911,511. Nov. 28, 1962. Priority date May 14, 1959, United States.

A reactor fuel element structure is designed so that withdrawal of one or more elements does not affect the positioning of the other elements. The structure comprises a plurality of vertical fuel elements with interlocking means at their upper ends for engaging adjacent elements. Two embodiments of the interlocking means are described. (D.L.C.)

9909 NUCLEAR FUEL ELEMENT CONSTRUCTION. (to U. S. Atomic Energy Commission). British Patent 911,593. Nov. 28, 1962. Priority date Dec. 31, 1958, United States.

A reactor fuel element is described with means for retaining volatile fission products within the element. The means comprises a fluoride conversion material for reacting with the barium and cesium fission products to form relatively involatile fluorides, and it is located inside the fuel containers, preferably as a coating on the outer surface of the fuel body or compact. The conversion material is a fluoride of Pb, Mg, Zr, Ce, Fe, or Cr. This method of retaining fission products is especially useful in the case where the fuel container is made of graphite. (D.L.C.)

9910 IMPROVEMENTS IN AND RELATING TO MEASUREMENT AND/OR INDICATION OF FLUID FLOW. Peter Beaumont (to General Electric Co. Ltd.). British Patent 911,612. Nov. 28, 1962. Filed Sept. 8, 1959.

This device has been developed principally for use in the gas flow circuit of a gas-cooled nuclear reactor. A vane provides a torque in a pivoted member when exposed to fluid flow. An opposing torque is produced by electromagnetic means. (R.J.S.)

9911 IMPROVEMENTS IN OR RELATING TO HEAT EXCHANGERS. (to Commissariat à l'Energie Atomique). British Patent 911,704. Nov. 28, 1962. Priority date Nov. 25, 1958, France.

A device is designed for increasing the rate of heat transfer from reactor fuel elements to the fluid coolant without excessive pressure drop. The device is a guide member of an aerofoil cross section arranged in the fluid path with the extrados facing the fuel element and orifices between the extrados and intrados. The orifices form fluid jets which break up the boundary layer of fluid

around the element. The aerofoil may be in the form of an annulus or a helix about the fuel element. (D.L.C.)

9912 IMPROVEMENTS IN OR RELATING TO SEALING MEANS FOR THIN WALLED TUBULAR MEMBERS. Thomas Frederick Ball (to United Kingdom Atomic Energy Authority). British Patent 911,706. Nov. 28, 1962. Filed Jan. 21, 1960.

A process is described for effecting a pressure-resistant seal where a thin walled tubular member passes through a surrounding member. The process is particularly concerned with the weld sealing of metal-sheathed mineral-insulated cable to surrounding members. (R.J.S.)

9913 IMPROVEMENTS IN OR RELATING TO SHEATHING THE FUEL ELEMENTS OF NUCLEAR REACTORS. Claude Beernaert (to Commissariat à l'Énergie Atomique). British Patent 911,710. Nov. 28, 1962. Priority date May 11, 1959, France.

An improved process for sheathing cluster-type reactor fuel elements is given which prevents the drawing of the sheath sheets with consequent variation in the sheath thickness. The process comprises placing a flexible support between the sheath sheets so that lateral displacement of the fuel rods during the forming process is possible, and removing the support after the forming process. The flexible support may comprise a deformable but almost uncompressible substance contained between the extremities of the rods, or a number of metallic wires stretched longitudinally inside hollow rods. (D.L.C.)

9914 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR PLANT. (to Babcock and Wilcox Ltd.). British Patent 911,770. Nov. 28, 1962. Priority date Sept. 16, 1960, Germany.

A nuclear reactor plant is designed with an auxiliary closed chamber over part of the pressure vessel. The auxiliary chamber is to contain any radioactive substances escaping through the charge tubes in case of accident; the rest of the pressure vessel has a wide safety margin and may be expected to withstand accidents. Thus, the need for a large, expensive containment vessel surrounding completely the pressure vessel may be circumvented. (D.L.C.)

9915 APPARATUS FOR THE GENERATION OF SHORT-TIME NEUTRON IMPULSES. (to Brown, Boveri, and Cie and Beteiligungsund Patentverwaltungsgesellschaft Mit Beschränkter Haftung). British Patent 912,222. Dec. 5, 1962. Priority date Nov. 25, 1960, Germany.

A reactor is designed for generating neutron pulses by passing fissile material through channels in the reactor vessel. The stationary fissile material in the vessel is subcritical, and the speed of the passing fissile material may be varied by varying the resistance inside the channels. The fissile material may be in the form of fuel embedded in graphite balls. (D.L.C.)

9916 IMPROVEMENTS IN NUCLEAR REACTORS. (to Babcock and Wilcox Ltd.). British Patent 912,731. Dec. 12, 1962. Priority date June 29, 1960, Germany.

A reactor is designed in which there is little tendency for the moderator blocks to be lifted by the coolant pressure drop. In the reactor, the coolant inlet chamber is connected through ducts to the lower ends of the fuel channels so that the coolant inlet pressure is not applied to the underside of the core. Horizontal channels are provided between the opposed end faces of the blocks and connecting with vertical channels between the block columns, so that the whole of the moderator structure is subjected to the coolant outlet pressure. (D.L.C.)

9917 NUCLEAR REACTOR PLANTS. (to Sulzer Freres, Societe Anonyme). British Patent 913,184. Dec. 19, 1962. Priority date May 17, 1960, Switzerland.

The fuel elements of a heterogeneous reactor are associated with pressure tubes through which a working medium flows. A considerable increase is permitted in the temperature of the working medium vapor leaving the reactor, thus improving the thermodynamic efficiency of the plant. (R.J.S.)

9918 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Andre Huet. British Patent 913,307. Dec. 19, 1962. Priority date May 27, 1958, France.

A fuel element assembly is designed for boiling reactors. The assembly comprises a set of fuel rods contained within a jacket open at each end, and motion is imparted to the jacket in order to remove vapor bubbles from the rod surfaces. The jacket motion is effected either by mechanical rotation or by the jacket design, which may have helical fins or be in the shape of a venturi or nozzle. (D.L.C.)

9919 NUCLEAR REACTOR PLANT. (to Sulzer Freres, Societe Anonyme). British Patent 913,397. Dec. 19, 1962. Priority date Apr. 11, 1960, Switzerland.

The heat evolved in a nuclear reactor is used in a heat-utilization plant by a working medium which is vaporized outside the reactor. Two separate circuits extend through the reactor. One circuit is a working medium circuit which includes the utilization plant. The other is a heat carrier circuit for conveying heat to the vaporizer. (R.J.S.)

9920 CONTROL ROD DRIVE SYSTEM. (to General Dynamics Corp.). British Patent 913,405. Dec. 19, 1692. Priority date Aug. 9, 1960, United States.

A control rod drive system is designed for controlling the power level of reactors having prompt negative temperature coefficients, e.g., TRIGA reactors. The system allows the rapid startup of a reactor in a few seconds and the stepping up of the power level to a high value. (D.L.C.)

9921 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. (to Babcock and Wilcox Co.). British Patent 913,656. Dec. 19, 1962. Priority date Oct. 30, 1958, United States.

A reactor fuel element assembly of the pin bundle type is designed with simple means for spacing the pins apart in the container. The spacing means comprises helical springs located between the pins. (D.L.C.)

9922 IMPROVEMENTS IN OR RELATING TO HOMOGENEOUS NUCLEAR REACTORS. (to Allmanna Svenska Elektriska Aktiebolaget). British Patent 913,714. Dec. 28, 1962. Priority date Dec. 2, 1959, Sweden.

A method is described for controlling the quantity of fission gas in the core of a homogeneous boiling reactor. (R.J.S.)

9923 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENT CHARGING APPARATUS FOR NUCLEAR REACTORS. (to Societe Indatom and Compagnie des Ateliers et Forges de la Loire). British Patent 913,742. Dec. 28, 1962. Priority date Mar. 27, 1959, France.

An unloading and loading apparatus is designed for gas-cooled reactors. The apparatus comprises two sealed compartments, one for loading and the other for unloading, and pumping means connected between the two compartments. In operation, the loading compartment is kept at atmospheric pressure during its filling with fresh fuel elements, while the unloading compartment is kept at reactor pressure during its filling with used fuel elements from the reactor.

After the compartments are filled, valves are opened to equalize the pressure in the compartments, and a pump is started to draw more gas into the loading compartment until its pressure is equal to the reactor pressure. The reactor loading procedure is then carried out. (D.L.C.)

9924 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Georges Lemesle, Roger Martin, Rene Babule, and Pierre Rouge (to Commissariat à l'Energie Atomique). British Patent 913,818. Dec. 28, 1962. Priority date Oct. 18, 1958, France.

A solid moderator structure is designed whose mechanical stability and rigidity are greatly enhanced. The structure comprises a plurality of parallel adjacent prismatic bars with longitudinal keyways formed in the bars and keying means engaging the lateral walls of the keyways with a sliding fit. Radial clearance is provided between adjacent bars to permit radial expansion without relative movement between the longitudinal axes of the bars. (D.L.C.)

9925 IMPROVEMENTS IN OR RELATING TO CERAMIC FUEL FOR NUCLEAR REACTORS. Lawrence Henry Cope and Ronald George Sowden (to United Kingdom Atomic Energy Authority). British Patent 913,858. Dec. 28, 1962. Filed June 26, 1959.

A method is described of incorporating fissionable material in a ceramic diluent matrix at a relatively late stage in the manufacture of a ceramic nuclear fuel body. Handling of highly radioactive fissionable material is limited as a result. (R.J.S.)

9926 IMPROVEMENTS IN NUCLEAR REACTORS. Norman George Worley (to Babcock and Wilcox Ltd.). British Patent 913,867. Dec. 28, 1962. Filed Jan. 27, 1958.

A fluid-cooled nuclear reactor is described that has improved characteristics as regards bulk coolant outlet temperature in relation to maximum permissible can surface temperature or temperature at the center of the fissile material. (R.J.S.)

9927 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR MODERATORS. (to Societe Nationale d'Etude et de Construction de Moteurs d'Aviation). British Patent 913,887. Dec. 28, 1962. Priority date Dec. 4, 1959, France.

A solid moderator element assembly is designed for high-temperature gas-cooled reactors under high pressure and subjected to accelerations and inclinations. The assembly comprises a plurality of parallel moderator columns formed by stacked elements and having axial channels for the cooling of fuel elements. Clearances between the columns are provided for lateral expansion, and the columns are supported by resilient guide means which allow axial expansion. The resilient guide means comprise helical springs compressed between the columns and members on the side of the pressure vessel. (D.L.C.)

9928 IMPROVEMENTS IN OR RELATING TO GAS-COOLED NUCLEAR REACTORS. James Simon Picton (to Babcock and Wilcox, Ltd.). British Patent 913,897. Dec. 28, 1962. Filed Apr. 1, 1960.

A gas-cooled nuclear reactor is described which is to be fueled while under load and has upright fuel channels arranged for upward flow of coolant and upward withdrawal of fuel elements. The rate of coolant flow through a channel is limited by a flow restrictor when a fuel element is lifted from the channel. (R.J.S.)

9929 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. David William Williams and Alec Donald Street (to United Kingdom Atomic Energy Authority). British Patent 913,920. Dec. 28, 1962. Filed Oct. 21, 1960.

A nuclear reactor fuel element is described which includes a region of preferential initial oxidation on its surface, a protective sheath, and a part positioned within the sheath in such a manner that increase in volume on oxidation causes the part to breach the sheath. (R.J.S.)

9930 IMPROVEMENTS IN AND RELATING TO THE CANNING OF FISSILE MATERIAL. Kenneth Maddocks (to Yarrow and Co. Ltd.). British Patent 913,928. Dec. 28, 1962. Filed Aug. 11, 1959.

A nuclear reactor fuel rod is canned with a thin gauge metal having a cylindrical wall formed with circumferential corrugations. A series of disc-like pellets of fissile material are housed in the can. The peripheral surfaces of the pellets have grooves into which the inwardly extending portions of the corrugations of the can extent. (R.J.S.)

9931 FUEL ELEMENT. (to Combustion Engineering, Inc.). British Patent 914,163. Dec. 28, 1962. Priority date Dec. 5, 1960, United States.

A reactor fuel element is designed with burnable poison in its cladding. The cladding is formed in two layers, the outer layer being a corrosion-resistant material, e.g., Zr, and the inner layer being a dispersion of boron in the corrosion-resistant material. Thus, boron does not come into contact with the reactor coolant and hence does not affect the corrosion rate. (D.L.C.)

9932 METHOD OF AUTOMATIC CONTROL OF A NUCLEAR REACTOR. Pavel Kovanic and Milan Kulka (to Zavody V. I. Lenina Plzen, Narodni Podnik). British Patent 914,178. Dec. 28, 1962. Priority date Feb. 18, 1958, Czechoslovakia.

A method is described for automatically controlling a nuclear reactor during startup from the subcritical state. The reactor control rods are moved in response to a control signal. This signal corresponds to the difference between a predetermined demand signal and the output signal of a detecting element in the radiation field. (R.J.S.)

9933 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS. Marc Salesse and Jacques Stohr (to Commissariat a l'Energie Atomique). British Patent 914,351. Jan. 2, 1963. Priority date Jan. 15, 1958, France.

A fuel element for a nuclear reactor comprises a number of bars of fuel located individually in a one-piece sheath structure. The structure comprises cylindrical sheaths having parallel axes coupled by planar webs. (R.J.S.)

9934 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Roddie McKeague and Thomas Anderson (to United Kingdom Atomic Energy Authority). British Patent 914,380. Jan. 2, 1963. Filed Jan. 23, 1961.

Means are described for measuring the coolant temperature in fuel element channels through the use of thermocouples. (R.J.S.)

9935 IMPROVEMENTS IN OR RELATING TO APPARATUS FOR DETERMINING THE LOCATION OF PERFORATION DEFECTS IN THE SHEATHS OF TUBULAR BODIES. Raymond Williams, William Hawkridge Roberts, and Stuart Turner (to United Kingdom Atomic Energy Authority). British Patent 914,485. Jan. 2, 1963. Filed Mar. 15, 1960.

A member defining an annular draw-off groove and a member defining a helical draw-off groove are arranged concentrically. A pressurized detector gas escaping from

the sheath of a nuclear reactor fuel element passes through both members allowing two indications of the gas to be obtained. (R.J.S.)

9936 CORE SAMPLING APPLIANCE FOR GRAPHITE-TYPE NUCLEAR REACTOR. (to Commissariat a l'Energie Atomique). British Patent 914,496. Jan. 2, 1963. Priority date May 30, 1959. France.

A moderator sampling device is described that consists of an elongated frame capable of being introduced into a duct in the moderator. A cutting tool equipped with a drive provides means for extracting a graphite sample. (R.J.S.)

9937 BOILING WATER NUCLEAR REACTOR AND METHOD FOR CONTROLLING THE SAME. (to General Nuclear Engineering Corp.). British Patent 914,517. Jan. 2, 1963. Priority date Aug. 26, 1960, United States.

The power output of a boiling water reactor is in part or wholly regulated by regulating the sub-cooling of the feedwater delivered to the reactor. (R.J.S.)

9938 IMPROVEMENTS IN AND RELATING TO HETEROGENEOUS NUCLEAR REACTORS. Michael Carl Hartnell-Beavis (to General Electric Co., Ltd.). British Patent 914,599. Jan. 2, 1963. Filed Aug. 19, 1960.

Canned fuel elements are located in channels in a core of moderating material. Mass flow of coolant over the fuel elements is varied in accordance with the neutron flux distribution along each channel. A substantially uniform can temperature of the fuel element is thus ensured. (R.J.S.)

9939 IMPROVEMENTS IN OR RELATING TO NUCLEAR FUEL ELEMENTS. William Leslie Mercer and Peter James Phennah (to General Electric Co., Ltd.). British Patent 914,614. Jan. 2, 1963. Filed June 1, 1960.

The design of a fuel element for a gas-cooled nuclear reactor is presented. The fissile material is encased in a protective can having closure means. In the event of a leak in the can adjacent to the closure, any chemical reaction between the reactor coolant and the body will effect an increase in the magnitude of the leak. (R.J.S.)

9940 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. David Lawry Booth (to English Electric Co. Ltd.). British Patent 914,680. Jan. 2, 1963. Filed Oct. 27, 1960.

Inlet means are provided for passing at least one stream of gas through at least part of the liquid moderator contained in the vessel of a reactor. The density of the moderator in the vicinity of the gas is reduced. An outlet is provided for exhausting the gas from the vessel. (R.J.S.)

9941 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR SERVICING MACHINES. Robert Andrew Wright (to General Electric Co. Ltd.). British Patent 914,922. Jan. 9, 1963. Filed Sept. 1, 1960.

A servicing machine has been designed to charge and discharge heterogeneous gas-cooled nuclear reactors. (R.J.S.)

9942 IMPROVEMENTS IN OR RELATING TO WATER HEATING INSTALLATIONS. Andre Huet. British Patent 915,056. Jan. 9, 1963. Priority date May 16, 1958, France.

A water heating installation is described that utilizes the heat from fluid flowing from a nuclear reactor. An evaporator is connected to at least one economizer in a manner that allows the economizer to be bypassed. (R.J.S.)

9943 IMPROVEMENTS IN NUCLEAR REACTORS. (to Babcock and Wilcox Co.). British Patent 915,190. Jan. 9, 1963. Priority date Mar 9, 1959, United States.

A nuclear reactor is described that includes a reactive core and neutron-absorbing means arranged to control the reactivity of the core. A number of movable neutron-absorbing control rods vary the core reactivity during operation of the reactor. Other neutron-absorbing elements are inaccessible during reactor operation but are readily removable when the reactor is shut down. (R.J.S.)

9944 IMPROVEMENTS IN METHODS AND DEVICES FOR DETECTING THE PRESENCE OF FISSION PRODUCTS IN THE COOLANT FLUID STREAMS OF A NUCLEAR REACTOR. Rene Donguy and Jean Megy (to Commissariat a l'Energie Atomique). British Patent 915,215. Jan. 9, 1963. Priority date Dec. 2, 1959, France.

A method and device are described for monitoring the radioactivity level in fluid streams used for cooling fuel elements in heterogeneous nuclear reactors for the purpose of detecting failure of the canning of the fuel elements. (R.J.S.)

9945 IMPROVEMENTS IN OR RELATING TO CONTROL ARRANGEMENTS FOR NUCLEAR REACTORS. Robert Arthur Geary (to General Electric Co. Ltd.). British Patent 915,309. Jan. 9, 1963. Filed May 4, 1959.

Two control bodies are arranged to be inserted into the core of a nuclear reactor. The first body is hollow and is adapted to provide at least a partial housing for the second body. The two bodies are capable of movement axially relative to each other for performing separate control functions. (R.J.S.)

9946 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Walter Berndt Carlson (to Babcock and Wilcox Ltd.). British Patent 915,331. Jan. 9, 1963. Filed May 17, 1960.

A tubular nuclear fuel element sheath or can is provided with fins arranged to form a helical series of channels that progress in a number of turns longitudinally of the can or sheath. (R.J.S.)

9947 A CORE FOR A THERMAL NUCLEAR REACTOR. (to General Nuclear Engineering Corp.). British Patent 915,338. Jan. 9, 1963. Priority date Mar. 14, 1960, United States.

The problem of hot spots in a thermal nuclear reactor core is alleviated by arranging the fuel assemblies so that all the fuel elements are adjacent to moderator-filled channels. The fuel elements thus operate in substantially the same thermal neutron flux. The core is controlled by adjustable control rods. (R.J.S.)

9948 METHOD AND APPARATUS FOR LOCATING RUPTURED NUCLEAR FUEL ELEMENTS. (to General Nuclear Engineering Corp.). British Patent 915,339. Priority date May 2, 1960, United States.

A method is described for locating a ruptured fuel element in the core of a nuclear reactor containing a number of fuel elements. The power output of confined areas of the core is sequentially increased and the radioactivity level of the reactor effluent is measured. The area within which the greatest change in radioactivity level occurs is the area containing the ruptured fuel element. (R.J.S.)

9949 IMPROVEMENTS IN OR RELATING TO SAFETY DEVICES FOR NUCLEAR REACTORS. Peter Harris Jones (to Rolls-Royce and Associates Ltd.). British Patent 915,362. Jan. 9, 1963. Filed June 25, 1959.

A safety device is described for a nuclear reactor in which the absorber elements are moved vertically between their operative and inoperative positions under scram conditions. Locking means retain the absorber elements against substantial displacement from their operative positions and are activated by tilting of the reactor from its normal position through a preselected angle. (R.J.S.)

9950 IMPROVEMENTS IN AND RELATING TO HETEROGENEOUS NUCLEAR REACTORS. Michael Carl Hartnell-Beavis (to General Electric Co. Ltd.). British Patent 915,370. Jan. 9, 1963. Filed Aug. 19, 1960.

The core structure comprises a body of moderating material containing channels adapted to receive fuel elements. The channels are uniformly distributed on a lattice. Certain of the channels are provided with removable plugs of moderating material so that the degree of under-moderation can be varied by substitution of fuel for the plugs as required. (R.J.S.)

9951 NUCLEAR REACTOR INSTALLATIONS. (to Sulzer Freres Societe Anonyme). British Patent 915,383. Jan. 9, 1963. Priority date Mar. 3, 1960, Switzerland.

A nuclear reactor is cooled by steam moving in a primary circuit. The heat in the superheated steam is transferred in a heat exchanger to either water or steam in a secondary circuit. The two circuits are interconnected by at least one pipe including a throttle valve controlled by a pressure-regulating element. (R.J.S.)

9952 IMPROVEMENTS IN NUCLEAR REACTORS. (to Babcock and Wilcox Ltd.). French Patent 1,210,082. Sept. 28, 1959.

A column of fuel rods is firmly supported laterally in a vertical channel of a naval reactor by means of spiders with laterally rotatable legs, each spider being attached to the bottom end cap of a rod. The upper end cap of each rod is provided with a knob. Thus when the fuel rods are stacked the weight of a rod in conjunction with the knob of the adjacent lower rod causes the spider-legs of the upper rod to be moved outwards and pressed against the wall of the channel. (NPO)

9953 STRUCTURE OF A CASING COMPRISING A CYLINDRICAL BODY WITH HELICAL FINS. (to Commissariat à l'Energie Atomique). French Patent 1,218,482. Dec. 21, 1959.

The patent describes a nuclear fuel element casing having a cylindrical body and fins, the fins forming in circumferential direction alternately two types of sets of portions of helices. Each set, the direction of which is longitudinal, is composed of portions of helices which are parallel to one another, but the direction of which is opposite to that of the helices in the adjacent set. Either narrow longitudinal passages without fins can be provided between adjacent sets, or the fins of adjacent sets can be connected to form complete herring-bones right round the body of the casing. (NPO)

9954 STRUCTURE OF A CASING COMPRISING A CYLINDRICAL BODY WITH HELICAL FINS. (to Commissariat à l'Energie Atomique). French Patent of Addition No. 77,374 (Addition to French Patent 1,218,482). Jan. 15, 1962.

In a first embodiment the fuel element casing comprises a cylindrical body with sets of portions of helical parallel fins having substantially a longitudinal direction. Narrow longitudinal as well as transverse passages without fins are provided between adjacent sets, the direction of the helices in each set being opposite to that in each adjacent set. In a second embodiment the sets form circumferential bands separated by transverse passages, the direction of the helices in each band being opposite to that in the adjacent bands. (NPO)

9955 IMPROVEMENTS IN FUEL ELEMENTS FOR NUCLEAR REACTORS. (to C. A. Parsons and Co., Ltd.). French Patent 1,231,675. Apr. 19, 1960.

The patent describes a rod-type fuel element with helical fins which are interrupted by longitudinal baffles, bracing and locking means being provided to restrict radial, circumferential, and axial movements of said baffles. (NPO)

9956 IMPROVEMENTS IN METHODS OF OPERATING NUCLEAR REACTOR ELEMENTS. (to S. A. d'Etudes et Réalisations Nucléaires Sodern). French Patent of Addition No. 76,850 (Addition to French Patent 1,238,281). Oct. 30, 1961.

The patent relates to a nuclear reactor in which fuel elements are applied, the canning of which transmits infrared radiation. The core of the reactor is provided with a honeycomb structure in the cells of which the fuel elements are mounted, the walls of the structure being corrugated and covered with a material that absorbs infrared radiation. (NPO)

9957 NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,245,913. Oct. 3, 1960. Priority date Jan. 20, 1959, Great Britain.

A method for testing a damaged fuel cartridge in a gas-cooled nuclear reactor is present. The method consists of sampling coolant gas which has passed over fuel cartridges in the reactor, passing the sample gas over a surface which is under the influence of an electric field so that solid daughter products of fission products are precipitated on this surface, and monitoring this surface to detect beta particles and gamma rays of energies greater than 3 Mev. The principal solid daughter product detected is Rb^{88} derived from Kr^{88}. Rb^{88} emits beta particles in the range 2 to 5.2 Mev. (IIB)

9958 FUEL COMPOSITION FOR NUCLEAR REACTORS. (to U. S. Atomic Energy Commission). French Patent 1,260,309. Mar. 27, 1961.

Fused-salt fuel for nuclear reactors, consisting of (1) 0.01 to 50 wt.% of at least one of the elements U, Th, and Pu in the form of oxides, halogenides, and/or salts containing oxygen, and (2) at least one component of the classes (a) S in the form of sulfur oxides, metal sulfates, metal sulfites, metal halogensulfonates, and/or sulfur acids, (b) halogen in the form of metal halogenides, metal halogensulfonates, and/or metal halogenphosphates, (c) P in the form of phosphorus oxides, metal phosphates, metal phosphites, and/or metal halogenphosphates, and (d) at least one oxide of a nonmetal and/or of another metal as those mentioned under (1), the halogen and/or sulfur quantity constituting at least 1 atom c/o of the total quantity of S, P, and halogen atoms in the total mass and the quantity of the components (2a), (2b), and (2c) constituting at least 60 wt.% of the U, Th, and Pu-free part of the mass is shown. Numerous examples of possible compositions are given. (NPO)

9959 ARRANGEMENT FOR ELIMINATING RADIOACTIVE IMPURITIES FROM THE GAS COOLANT CIRCUIT OF A NUCLEAR REACTOR. (to Brown, Boveri and Cie., A. G. and Beteiligungsund Patentverwaltungsgesellschaft m.b.H.). French Patent 1,261,526. Apr. 10, 1961.

The purification circuit for the gaseous coolant of a nuclear reactor contains a strongly cooled adsorption filter which is preceded by an analogous filter, operating at a higher temperature. The dimensions of the latter are such that the greater part of the radioactive impurities decompose during their passage through the filter. (NPO)

9960 BOILING WATER REACTOR COMPRISING A WATER-STEAM SEPARATOR INSIDE THE PRESSURE VESSEL. (to Licentia Patent-Verwaltungs-G.m.b.H.). French Patent 1,262,780. Apr. 24, 1961. Priority date June 12, 1959, Germany.

A boiling water reactor has a core composed of a plurality of vertical fuel elements through which the boiling water rises. Each fuel element is extended at its upper extremity by a vertical riser for optimizing the circulation of the boiling water. According to this patent means are provided for maintaining the water level at a given height over the upper ends of the risers, while each riser encloses a water-steam separator inducing in the water-steam mixture a giratory movement and has a vertical tube for evacuating the steam from the axis of the riser and for leading it into the space above the water level. (IIB)

9961 BOILING REACTOR WITH NUCLEAR VAPOR SUPERHEATING. (to Société Belge pour l'Industrie Nucléaire). French Patent 1,266,085. May 29, 1961. Priority dates Aug. 25, 1959 and Feb. 18, 1960, Belgium.

The patent relates to boiling reactors of the kind comprising tubular nuclear fuel elements. These fuel elements may have the shape of straight tubes or any other shape, e.g., of a single or double spiral. According to a first embodiment cooling liquid is fed into tubular fuel elements where it evaporates, the formed vapor being led along the outside of the fuel elements where it is superheated. According to a second embodiment the vapor is formed by evaporating the liquid occupying the space between the fuel elements, the vapor flowing afterwards through the tubular fuel elements where it is superheated. Suitably in the reactor according to the second embodiment a liquid-vapor mixture formed in the space between the fuel elements is led to a vapor drum where the vapor is separated from the liquid, this vapor being fed into the fuel elements. (IIB)

9962 IMPROVEMENTS RELATING TO METHODS OF OPERATING GAS COOLED NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,266,812. June 5, 1961. Priority date Sept. 4, 1959, Great Britain.

In a method of operating a gas-cooled nuclear reactor associated with fuel element leak detector apparatus for detecting short-lived fission products, the pressure in the coolant circuit while the reactor is operating at power is reduced whereby fission products are forced through any existing leaks in the fuel element sheaths into the coolant stream for detection by detector apparatus. If the coolant pressure is reduced relatively quickly, this will change the pressure drop across the sheath and probably also lead to some slight relative movement between the sheath and the fuel member. Both of these effects will tend to squeeze gas containing fission products from inside the sheath into the main coolant stream where they can be detected. (IIB)

9963 HEAT TRANSFER SYSTEM. (to Sulzer Frères S. A.). French Patent 1,269,363. July 3, 1961. Priority date July 20, 1959, Switzerland.

This patent relates to a heat transfer system of the kind comprising at least two media which flow in opposite directions. The first medium which releases heat has an approximately constant entry temperature, and its flow velocity is altered according to the quantity of heat this medium is to supply in such a manner that its outlet temperature also remains almost constant. The second medium which absorbs heat is a working medium which is vaporized and superheated in the heat transfer system. In a nuclear power plant the first medium is, e.g., the gaseous reactor coolant. According to this patent, the heat transfer system comprises several sections through which the working medium flows consecutively with an increased heat content. The section carrying the working medium with the lowest heat content is located in the coolest zone of flow of the first medium, while the section carrying the working medium with the greatest heat content is located in the hottest zone of flow of the first medium. At least one of the sections carrying working medium with an intermediate heat content is advanced into a zone of flow of the first medium that is hotter than corresponds to the flow sequence of the working medium. (IIB)

9964 IMPROVEMENTS IN VAPOR GENERATORS. (to Babcock and Wilcox Ltd.). French Patent 1,270,452. July 17, 1961. Priority date Nov. 5, 1959, Great Britain.

A vapor generator incorporated in a nuclear power plant for ship propulsion has a lower drum containing a bank of heat exchange tubes and upright risers extending between the top and the bottom of an upper drum. These risers open at their upper ends into a vapor and liquid compartment situated within the upper drum and arranged to discharge a mixture of vapor and liquid into separating means adopted to discharge liquid downwardly below a normal liquid level within the upper drum and vapor upwardly to a vapor space within the upper drum. Downcomers are arranged outwardly of the risers in order to conduct liquid from the upper drum to the lower drum. (IIB)

9965 IMPROVEMENTS RELATING TO BOILING WATER REACTORS. (to General Nuclear Engineering Corporation). French Patent 1,270,886. July 24, 1961. Priority date Oct. 9, 1959, United States.

A boiling water reactor comprises two different ways of circulation for the boiling water flowing through the reactor core and well, a forced circulation for a central region of the core, and a natural circulation for the periphery region enclosing said central region. Suitably two coaxial vertical tubular dividing walls are placed within the reactor vessel, the inner one enclosing the fuel elements of the central region and being open at its top, while the fuel elements of the periphery region are placed within the annular space formed between the two coaxial dividing walls. The inner dividing wall reaches with its lower end to the bottom of the pressure vessel where an entrance tube is provided for entering the water flow of the forced circulation. The annular space is fed via its open lower extremity with water in natural circulation coming from the remaining space within the vessel filled with water to a level higher than the upper borders of the dividing walls. The water cycle of the natural circulation is closed either within the pressure vessel or via header means situated inside the pressure vessel over a steam drum disposed outside the pressure vessel. (IIB)

9966 DEVICE FOR MEASURING THE NEUTRON FLUX IN NUCLEAR REACTOR. (to Commissariat à l'Energie Atomique). French Patent 1,271,234. July 31, 1961. Filed July 29, 1960.

A device for measuring the neutron flux in nuclear reactors comprises a fixed tube reaching through an access hole in the reactor shielding with its closed extremity into the proximity of the reactor core. A piston in this tube is fixed on a second tube situated coaxially in the first tube and forms an axially displaceable stop for a mass to be irradiated sliding on the second tube. This mass is adapted to be displaced by gas pressure between a first position where the mass rests against the stop and a second position where the mass rests against the other extremity of the fixed tube, this extremity being enclosed by a radiation counter for measuring the radioactivity of the mass induced by the neutron flux in its first position. This radioactivity is a measure of the neutron flux in the proximity of the stop. (IIB)

9967 MACHINE FOR DECANNING NUCLEAR REACTOR FUEL ELEMENTS. (to Commissariat à l'Energie Atomique). French Patent 1,271,235. July 31, 1961.

The machine for decanning fuel rods comprises two semi-cylindrical jaws between which the canned rod is fixed and which bring about a longitudinal bulging of the can, a cutting tool which slits open the bulge, and a pusher which extrudes the fuel rod from the slit can. (NPO)

9968 OPERATING PROCESS FOR A NUCLEAR REACTOR AND A REACTOR FOR APPLICATION OF THIS PROCESS. (to Deutsche Gold- und Silber-Scheideanstalt vormals Roessler). French Patent 1,272,972. Aug. 28, 1961. Priority date Sept. 4, 1959, Germany.

An operating process for a nuclear reactor consists in guiding nuclear fuel elements through the reactor core so that each fuel element passes successively through regions where it is submitted to neutron flux of different intensities. Suitably the fuel elements are displaced along conical spirals disposed concentrically with the vertical reactor axis. Generally a number of these spiral fuel element paths are disposed one within another. According to an embodiment, ball-shaped fuel elements are guided within spiral tubes partially filled with the same liquid occupying the remaining reactor core. Above the liquid level within the tubes an inert gas serves for maintaining this level constant. At each of the lower ends of the tubes a lock-chamber is provided so that one element or several elements simultaneously can pass through it. (IIB)

9969 IMPROVEMENTS RELATING TO CORE STRUCTURES FOR NUCLEAR REACTORS. Lamberto Paggi and John Oliver (to The Nuclear Power Plant Co., Ltd.). French Patent 1,273,272. Aug. 28, 1961. Priority date Nov. 12, 1959 and Oct. 13, 1960, Great Britain.

A nuclear reactor core structure comprises a plurality of adjacent columns, each column consisting of a series of graphite blocks placed one above the other. Each block is suitably provided with an axial boring in such a way that the borings of the blocks of the same column form a reactor channel. Each block has a cross section symmetric with respect to the block axis. The distances between the axis of a given block and the axis of the blocks of adjacent columns are determined by a system of keys engaging in keyways in the lateral faces of the blocks. These keyways have sidefaces parallel to planes including the axis of the block in question, so that the keys connecting adjacent blocks are oriented according to at least three different planes of these planes. Suitably two of these planes form a right angle, while the third forms a bisection of the right angle. (IIB)

9970 PROCESS FOR OPERATING AND CONTROLLING A NUCLEAR REACTOR. (to R.N.B. Corp.). French Patent 1,273,431. Sept. 9, 1961. Priority date Aug. 31, 1959, United States.

A process is described for operating and controlling a heterogeneous nuclear reactor moderated by graphite and water or light water, which consists in regulating the quantity of light water in the reactor core for controlling its effective reactivity. This core is fueled with fissile and fertile material distributed according to a lattice in said graphite moderator and is cooled by said water, the reactor being sub-moderated with respect to the graphite. The cooling water enters the core in the form of a spray, so that at each moment in each channel the relation between fast and thermal neutron flux is maintained at a given value, while the reactor remains in the critical state. (IIB)

9971 CONTAINER FOR THE LIQUID MODERATOR OF A NUCLEAR REACTOR. (to Commissariat à l'Energie Atomique). French Patent 1,273,932. Sept. 11, 1961. Filed Sept. 6, 1960.

A container for the liquid moderator of a nuclear reactor comprises within its upper region a bell-shaped dividing wall reaching with its lower open extremity to a level lower than the lowest moderator level within the container, while above the moderator level within the bell-shaped wall a gas is present under such a pressure that the space between the bell-shaped wall and the inner surface of the upper region of the container is completely filled with the liquid moderator. Means are provided for regulating the moderator level within the bell-shaped wall and well by regulating the gas pressure. Preferably the top of the container is provided with the liquid moderator exit duct, while the moderator entrance duct is provided at the bottom. (IIB)

9972 SODIUM COOLED GRAPHITE MODERATED NUCLEAR REACTOR. (to North American Aviation, Inc.). French Patent 1,274,088. Sept. 11, 1961. Priority date Nov. 27, 1959, United States.

A sodium-cooled graphite-moderated nuclear reactor comprises a reactor tank in which a reactor core container is supported spaced from the side walls and the bottom of the tank. A neutron shielding cylinder encloses the core container so that between this shielding cylinder and the side walls of the tank an annular space remains in which a heat exchanger is placed. From the space over the reactor core the sodium reactor coolant flows down through the annular space and is cooled there by the heat exchanger and afterwards circulated by electromagnetic pumps via the space under the core container through vertical tubes passing through this core container. The ends of these tubes are tightly connected with respectively the bottom and the top of the core container so that the sodium cooling the fuel elements placed in these tubes is not in contact with the graphite moderator structure enclosed by the core container. (IIB)

9973 STEAM COOLED NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). French Patent 1,274,194. Sept. 11, 1961. Priority date Nov. 26, 1959, Great Britain.

A heavy water-moderated nuclear reactor comprises a tank for the heavy water moderator and a plurality of vertical reactor tubes closed at the bottom enclosing the fuel elements, while steam circulates as a reactor coolant through these tubes. Within each of these tubes a cylindrical wall is provided forming with the inner tube wall an annular interspace. The steam coolant enters the interspace near the top of the tube, descends therein, and rises afterwards within the cylindrical wall in contact with the fuel elements. A part of the steam descending in the interspace is condensed at the inner wall of the reactor tube having a relatively low temperature. This condensed steam flows down along the inner wall and is assembled and evacuated at the bottom of the reactor tube. (IIB)

9974 LIQUID MODERATED NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). French Patent 1,274,195. Sept. 11, 1961. Priority date Nov. 26, 1959, Great Britain.

A heterogeneous nuclear reactor comprises a lattice of parallel reactor channels in which a fluid circulates for cooling the fuel elements placed therein and a moderator structure constituted by a bundle of vertical tubes partially filled with moderator liquid and closely pressed together. The outer surfaces of these tubes which do not touch adjacent tubes form the lateral walls of the reactor channels. Preferably the tubes and the reactor channels have hexagonal cross sections, while the cooling fluid is constituted of steam. For cooling the moderator, liquid is removed from the tubes at the bottom, passes a heat exchanger, and

is finally refed to the tubes at their tops so that the cold moderator liquid flows in the upper region of the tubes along the tube walls in order to remove heat from the walls. Preferably the cold moderator liquid first passes a separated space at the top of the tube in order to form reflector regions for the reactor core. (IIB)

9975 GRAPHITE MODERATOR SYSTEM FOR A NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). French Patent 1,274,244. Sept. 11, 1961. Priority date Nov. 26, 1959, Great Britain.

A moderator system for a nuclear reactor comprises a plurality of adjacent columns, each column consisting of a series of prismatic graphite blocks each provided with an axial boring and piled one above another, so that the borings of the blocks of the same column form a vertical reactor channel. In order to ensure the alignment of these borings, a system of centering pieces is provided. These centering pieces are constituted of a material having a low neutron cross section while the dimensions of them are stable under the influence of radiation. Three embodiments of systems of the centering pieces are described. (IIB)

9976 OPERATING PROCESS FOR A NUCLEAR REACTOR AND REACTOR FOR APPLICATION OF THIS PROCESS. (to Deutsche Gold- und Silber-Scheideanstalt). French Patent 1,274,265. Sept. 11, 1961. Priority date Nov. 26, 1959, Germany.

An operating process for a nuclear reactor consists in guiding nuclear fuel via tubes through the reactor core. These tubes contain a liquid moderator and have portions parallel to the reactor axis. According to a first embodiment these tubes have sloping portions going from the periphery to the center of the reactor. According to a second embodiment the tubes have the shape of conical or plane spirals, the nuclear fuel being fed to the spiral tubes at the outer extremities of them, while it is removed from the inner ones. The tube extremities reach respectively in an upper and a lower collecting chamber. Preferably the lower collecting chamber is partially filled with an inert gas, the pressure of which serves to maintain the moderator liquid level in the tubes. (IIB)

9977 HOMOGENEOUS BOILING REACTOR. (to Allmanna Svenska Elekriska Aktiebolaget). French Patent 1,274,336. Sept. 11, 1961. Priority date Dec. 1, 1959, Sweden.

A homogeneous nuclear reactor comprises an aqueous suspension of nuclear fuel in a casing placed within a pressure vessel, so that the outer wall of this casing and the inner wall of the pressure vessel form between them an annular interspace which is partially filled with water forming the reflector for the homogeneous reactor core. The casing is open at its top and communicates with the annular interspace via the upper region within the pressure vessel. The steam formed in the boiling reactor core rises in the pressure vessel, passing liquid-steam separating baffles, and leaves the pressure vessel at its top. This steam passes a heat exchanger where it is condensed. The condensed steam feeds the annular interspace which at its bottom is in communication with the bottom of the reactor core casing. (IIB)

9978 IMPROVEMENTS RELATING TO NUCLEAR REACTORS UTILIZING AN ORGANIC MATERIAL AS MODERATOR AND COOLANT. (to Commissariat à l'Energie Atomique and Institut Français du Pétrole, des Carburants et Lubrifiants). French Patent 1,275,006. Sept. 25, 1961. Filed Sept. 21, 1960.

In a nuclear reactor cooled by an organic liquid circulating successively through the reactor and a water cooled heat exchanger, a fraction of the organic liquid having a low resistivity against radiation effects is set apart in order to be burned in a superheater to superheat the steam produced in this heat exchanger. This fraction of organic liquid is replaced by essentially the same quantity of fresh organic liquid. (IIB)

9979 IMPROVEMENTS RELATING TO COOLING MEANS FOR INSTRUMENTS, IN PARTICULAR FOR T. V. CAMERAS UTILIZED INSIDE NUCLEAR REACTOR. (to Euratom). French Patent 1,276,199. Oct. 9, 1961. Priority date Dec. 18, 1959, Great Britain.

A T. V. camera utilized inside a nuclear reactor is enclosed by a suitably cylindrical casing. The casing is subdivided into a central region and two annular regions by two porous cylindrical dividing walls. The camera is situated inside the central region while the annular space between the two porous walls is fed with a liquid having at the operating pressure a boiling point near the maximum admissible temperature of the camera. During the operation the liquid diffuses through the porous walls into the adjacent regions where it is immediately vaporized. By appropriate ducts this vapor is led to a heat exchanger from which the condensed vapor is refed to the casing. The bottom of the casing is closed by a double-walled window for the camera. (IIB)

9980 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. (to General Nuclear Engineering Co.). French Patent 1,276,233. Oct. 9, 1961. Priority date Mar. 14, 1960, United States.

In heterogeneous liquid-moderated nuclear reactors spaces are often provided which do not enclose fuel elements and generally serve to receive the control elements of the reactor. The fuel elements adjacent to these spaces capture for this reason more thermal neutrons than other fuel elements. This effect causes an unequal heat production in the fuel elements. In order to avoid this, each of the elongated parallel fuel element assemblies of a nuclear reactor which are separated from each other by passages for the control elements is provided with at least one annular region. This annular region is coaxial with the axis of the assembly and contains fuel elements. Each of these regions embraces a region free of fuel so that each of the fuel elements receives equally the same thermal neutron flux. (IIB)

9981 COMPLETELY SELF-CONTAINED MECHANICAL SAFETY DEVICE FOR A NUCLEAR REACTOR. (to Commissariat à l'Energie Atomique). French Patent 1,277,379. Oct. 23, 1961. Filed Oct. 19, 1960.

A mechanical safety device for a nuclear reactor comprises a safety rod adapted to be introduced into the reactor core in case of danger, e.g., in case the neutron flux exceeds a given value. The safety rod is only restrained from its introduction into the reactor by a locking device coupling the rod with the reactor construction. The locking device comprises a tubular socket fixed to the reactor construction and provided near its end with lateral openings in which balls are situated, the outer portions of which engage with a shoulder provided in a piece fixed to the safety rod. The balls are held in an engaging position by a piston adapted to slide axially in the socket. For releasing the safety rod, a means sensitive to the neutron flux induces an axial displacement of the piston. These neutron-sensitive means may be uranium sheet covered with a metal layer having a low thermal expansion coefficient. (IIB)

9982 NUCLEAR REACTOR. (to Sulzer Frères S. A.). French Patent 1,277,777. Oct. 23, 1961. Priority date Feb. 12, 1960, Switzerland.

A nuclear reactor provided with a plurality of parallel channels passing through the core comprises in each of these channels a fuel cartridge provided at the same side of the reactor with couplings for the entrance and exit duct for the coolant circulating through this fuel cartridge, while means for charging and discharging these cartridges are disposed at the other side of the reactor. The reactor channels are preferably vertical and the couplings are disposed at the top of the reactor. The charging means comprise a horizontally movable shielded charging machine enclosing lifting means for introducing the fuel cartridge either into a reactor channel or, after tilting the charging machine into an inclined position, into means adapted for conveying the fuel cartridge from the charging machine to a storage pool and vice versa. (IIB)

9983 PROCESS FOR PREVENTING A CHEMICAL REACTION OF THE CARBON DIOXIDE COOLANT WITH THE GRAPHITE MODERATOR IN A NUCLEAR REACTOR. (to Allmanna Svenska Elektriska Aktiebolaget). French Patent 1,278,219. Oct. 30, 1961. Priority date Nov. 19, 1959, Sweden.

A process for preventing a chemical reaction of the carbon dioxide coolant with the graphite moderator in a nuclear reactor consists in continuous introduction of gaseous hydrogen into the coolant before it passes through the reactor, in continuous elimination of the formed steam, and in controlling the carbon dioxide fraction in the coolant by catalytic combustion with gaseous oxygen. (IIB)

9984 NUCLEAR FUEL ELEMENT. (to United Kingdom Atomic Energy Authority). French Patent 1,278,418. Oct. 30, 1961.

The patent relates to fuel elements of the Calder Hall type. In order to prevent superheating of the end caps, material having a greater neutron absorption cross section than the fuel is placed in the vicinity of the caps. Either strips of boron steel are inserted in the conical location members, which are screwed on to the end caps, or the fuel slug inside the canning is provided at both extremities with a steel hat, which does not impede the dilation of the slug. (NPO)

9985 SUPPORT STRUCTURE FOR NUCLEAR REACTORS. (to General Electric Co., Ltd.). French Patent 1,278,434. Oct. 30, 1961. Priority date Jan. 25, 1960, Great Britain.

A nuclear reactor core support structure comprises a core-supporting platform, a grillage beneath the platform, and a peripheral support on which the grillage is mounted. The grillage comprises a symmetrical arrangement of beams connected together at a central point and extending radially. The beams are supported at their outer ends on the peripheral support. Preferably these beams are connected at the central point by means of a common hub member to which they are welded. In this way the load is not only distributed uniformly around the peripheral support, but the multiplicity of welds between intersecting members of a grillage is avoided. This construction is especially applicable to a support structure for a reactor core of the kind composed of hexagonal blocks. (IIB)

9986 PROCESS FOR OPERATING NUCLEAR REACTORS. (to Siemens-Schuckertwerke A. G.). French Patent 1,278,491. Oct. 30, 1961. Priority date Jan. 30, 1960.

A process for operating a nuclear reactor consists in displacing the movable control elements by the effect of a boiling process, which develops in a specially chosen reactor tube enclosing a fuel element cooled by a liquid. Suitably this reactor tube is vertically disposed and fed at its lower extremity from the main coolant entrance header and well over throttling means, while its upper extremity is in communication with the upper region of a vertically disposed elongated casing in which the control element is movable in the vertical direction. This control element forms a float, the position of which is determined by the level of the liquid on which this float drives and which occupies at least the lower region of this casing, the lower extremity of which is in communication with the main coolant exit header of the reactor. The system is adjusted for self-regulation so that an increased reactor power causes an increased boiling, the formed vapor decreasing the liquid level in the casing, so that the control element enters more in the reactor core, decreasing in this way the reactivity. The vapor quantity is further regulated by controlled injection of liquid into the vapor space or by evacuation of a part of the vapor over a control valve. (IIB)

9987 ROTARY CONTROL ROD AND ITS DRIVE DEVICE. (to Commissariat à l'Energie Atomique). French Patent 1,278,701. Nov. 6, 1961. Filed Nov. 3, 1960.

A rotary control rod for nuclear reactors comprises an aluminum rod covered with two opposite quadrants of neutron-absorbing sheets, e.g., of cadmium, and is mounted by ball bearings in the axis of a fixed cylindrical aluminum tube, the inner surface of which is covered with similar opposite sheet quadrants. The neutron absorption of this control rod is in this way a function of the rotation of it. Suitably the tube and the rod are provided with an aluminum cladding for protecting the neutron-absorbing sheet quadrants. The rotation of the rod is controlled by an electric motor via a torque-limiting coupling, a position indicator, and a speed reduction system comprising suitably an axial screw engaging a nut hold from rotating. The rotation of the screw causes an axial displacement of the nut abutting via a roller on it against a helical edge of a cylinder coupled with the control rod. (IIB)

9988 REMOTE HANDLING AND VIEWING DEVICE WITH TELEVISION CAMERA. (to A.E.I.-John Thomson Nuclear Energy Comp., Ltd.). French Patent 1,278,832. Nov. 6, 1961. Priority date Dec. 17, 1959, Great Britain.

A remote handling and viewing device is formed by an assembly of an elongated cylindrical television camera suspended on the extremity of its flexible supplying cable and a mechanical remote handling device adapted to pick-up broken pieces of nuclear fuel elements and mounted on the lower extremity of the camera, this assembly being adapted to be lowered by the supplying cable into a reactor channel. An electric motor for controlling the remote handling device and for turning the camera around its axis is placed above the camera and is connected via two control shafts disposed beside the camera and parallel to its axis with the remote handling device, one shaft controlling the opening or closing of the gripping means, while the other one controls the orientation of the gripping means. (IIB)

9989 NUCLEAR REACTOR COOLED WITH A CIRCULATING FLUID, MODERATED BY LIGHT WATER AND WITH NUCLEAR SUPERHEATING. (to Licentia Patent-Verwaltungs-G.m.b.H.). French Patent 1,279,117. Nov. 6, 1961. Priority date Feb. 12, 1960, Germany.

A heterogeneous nuclear reactor comprises a plurality of vertical reactor tubes disposed within the reactor pressure vessel. The lower open ends of these tubes are in communication with the space enclosed by the reactor vessel and which is partially filled with water constituting the reactor cooling and moderating fluid. The tubes communicate via the upper open ends with a steam header placed above the reactor core within the reactor pressure vessel. The reactor cooling fluid entering these tubes at

their lower ends is heated while in contact with the reactor fuel elements placed within the tubes and is collected in the steam header before leaving the reactor vessel via an exit duct. The water level within the pressure vessel is higher than the top extremity of the steam header. The space above the level is in adjustable communication with the steam exit duct in order to control the steam pressure. In this way the coolant flow entering the reactor tubes is controlled. (IIB)

9990 TWO-SPEED DEVICE FOR THE DISPLACEMENT OF FOLLOWER MEANS IN NUCLEAR REACTORS. (to United States Atomic Energy Commission). French Patent 1,279,182. Nov. 6, 1961. Priority date June 22, 1960, United States.

A two-speed device comprises a movable two-part stop engageable with a follower urged against this stop by pneumatic means and connected with a control element of a nuclear reactor. The two-part stop consists of an inner screw sliding axially in a hole in a fixed member and is secured in it against rotation by a key and a key-way and of an outer screw being in threaded engagement with the inner screw and with a thread hole in the fixed member. The external threads of the inner screw and the outer screw are of opposite directions. A driving gear, driven by a reversible motor, meshes with a long gear wheel formed as an integral extension of the outer screw. A follower cup has a base and a flange which are engageable with the inner screw and the outer screw, respectively. When the outer screw is rotated, this screw moves up or down, depending upon the direction of rotation. As the interior thread on the outer screw has opposed directions with respect to the exterior thread thereon, the inner screw moves up or down with the outer screw but at a greater speed than the outer screw. The follower cup engages either the inner or the outer screw. (IIB)

9991 IMPROVEMENTS RELATING TO SEALING MEANS FOR NUCLEAR REACTORS. (to Electricité de France). French Patent 1,279,425. Nov. 13, 1961. Filed Nov. 9, 1960.

For the transmission of a rotary movement an axle passes freely through an opening in the wall of a vessel and is provided with means for sealing this opening during the stopping of the axle. This sealing means comprises a fixed sealing piece connected in a tight manner over the opening in the wall and may be coupled with a movable sealing piece axially slidable on the axle. This coupling is performed via two annular sealing elements fixed on the movable sealing piece and pressed against corresponding seatings provided on the fixed sealing piece. The sealing between the movable sealing piece and the axle on which it slides is performed by two further annular sealing elements. The interspaces between the sealing elements are connected with a gas line for sweeping out gases escaping from the vessel into the interspaces. (IIB)

9992 IMPROVEMENTS RELATING TO MECHANICAL DRIVE SYSTEMS FOR CONTROL RODS IN NUCLEAR REACTORS. (to Electricité de France). French Patent 1,279,476. Nov. 13, 1961. Filed Nov. 10, 1960.

A mechanical drive system for control rods in nuclear reactors, especially gas cooled reactors, comprises a system for transmission of power between a motor with reciprocating movement and a control rod. This transmission system transforms the reciprocating movement of the motor into a discontinuous rotary movement in the two orientations of rotation for the displacement of the control rod. Preferably the motor with reciprocating movement includes pneumatic drive means responsive to the difference of the pressure in the reactor pressure vessel and an auxiliary gas pressure. The transmission system comprises two planetary gear trains each having planet gears engaging with a rotary drum; the planet carrier of one of the gears is driven by a rack following the reciprocating movement of the motor. Two brakes are adapted to lock alternately the rotation of one wheel of each of the gear trains respectively, so that the rotary drum is alternately driven by one of the two planet gears. For choosing the orientation of rotation of the drum, the phase relation of the locking cycle to the reciprocating movement is chosen in an appropriate manner. In the case of danger both the two wheels are unlocked, so that the drum may freely rotate and the control rod shuts down into the reactor. (IIB)

9993 CONSTRUCTION OF PRESSURE TUBES FOR NUCLEAR ENERGY. Charles Gros. French Patent 1,279,967. Nov. 20, 1961. Filed Nov. 10, 1960.

Helically welded tubes with overlapping joints or banded tubes are used as pressure tubes in power reactors moderated with heavy water. (IIB)

9994 CONTROL ROD DRIVE FOR NUCLEAR REACTORS. (to Bailey Meter Company). French Patent 1,280,499. Nov. 20, 1961. Priority date Mar. 7, 1960, United States.

A control rod drive especially adapted for pressurized water reactors comprises a movable piston sliding in a cylinder. This piston is connected with the control rod by a coupling bar. A high-pressure source communicates via a first duct and throttling means in communication with one side of the piston, while a second duct having flow control means serves for evacuating the high-pressure water from this side of the piston to its other side. This other side may communicate via further flow control means with the inside of the reactor pressure vessel. The latter flow control means are normally in the open position. The pressure in the pressure source is higher than the pressure in the reactor pressure vessel, so that for holding the control rod in balance or for raising or lowering it, the pressure in the space at the side of the piston in communication with the pressure source can be controlled by controlling by the flow control means the evacuation of the pressurized water from the space. (IIB)

9995 FUEL ELEMENTS FOR NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,280,533. Nov. 20, 1961.

The fuel rod is provided at one of its extremities with a lateral support means consisting of a number of symmetrically placed bimetallic strips which are so curved that at the operating temperature of the reactor the strips contract the wall of the fuel channel. Vibration of the rod due to the passage of the coolant is in this manner prevented. (NPO)

9996 FUEL ELEMENTS FOR NUCLEAR REACTORS AND MEANS FOR THEIR FIXATION. (to United Kingdom Atomic Energy Authority). French Patent 1,281,809. Dec. 4, 1961.

The patent comprises a lateral support means for fuel rods of the well-known spider type, one of its legs being provided with a radially extensible part which is pressed against the channel wall under the action of a spring. The support prevents vibration of the rod. (NPO)

9997 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. (to United States Atomic Energy Commission) French Patent 1,281,825. Dec. 4, 1961. Priority date Mar. 15, 1960, United States.

A nuclear power plant includes a boiling water reactor with a water reflector, a steam turbine, and a condenser. A steam by-pass line connects the steam outlet duct of the

reactor with the condenser via successively throttle means and a valve opening the by-pass in case the steam pressure in the reactor surpasses a given value. A reflector discharge line connects the base of the reflector via valves with the condenser, while a feeding line connects the condenser via a pump with the top of the reflector space. A further line connects the reflector discharge line with the steam by-pass line and well between its throttle means and its valve. The pressure drop caused by the throttle means in the steam by-pass line induces, in the case of a too high steam pressure, water from the reflector to be conveyed with the steam flow in the by-pass line, in order to lower the reflector level for diminishing the reactivity. (IIB)

9998 NUCLEAR REACTOR. (to Sulzer Frères S. A.). French Patent 1,282,246. Dec. 11, 1961. Priority date Feb. 27, 1960, Switzerland.

In a vapor-cooled nuclear reactor in which the vapor is superheated and a fraction of the superheated vapor is fed to a vaporizer situated outside the reactor and forming the vapor coolant, the vapor before entering the reactor passes a preheater in order to prevent liquid droplets conveyed with the saturated vapor to enter the reactor. This preheater is heated by a fraction of the superheated vapor before it is fed to the vaporizer. According to a first embodiment the preheating is performed in a heat exchanger, while according to another embodiment the preheating is performed by mixing with superheated vapor. Preferably the reactor channels are subdivided into groups in which the coolant temperature is individually controlled, so that the group with the highest heat development works with the lowest coolant temperature and vice versa. (IIB)

9999 NEUTRON SHIELD FOR NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,283,113. Dec. 18, 1961. Priority date Mar. 11, 1960 and Mar. 2, 1961, Great Britain.

In a nuclear reactor a neutron shield is positioned in the pressure vessel between the moderator structure and the access holes in the pressure vessel wall. This neutron shield has holes for the passage of the control rods. According to this patent supplementary neutron shields are provided between the access holes in the pressure vessel wall and the holes in the neutron shield being in alignment with the access holes. The supplementary neutron shields are suitably fixed in the reactor construction and are each provided with a passage for the control rod suspension cable. According to another embodiment each supplementary shield is fixed to the control rod in question. (IIB)

10000 NUCLEAR REACTOR INSTALLATION. (to Sulzer Frères S. A.). French Patent 1,284,875. Jan. 8, 1962. Priority date Apr. 11, 1960, Switzerland.

In a nuclear reactor installation the reactor is cooled by a vapor formed outside the reactor. This vapor coolant passes through the reactor in at least two circuits separated one from another, so that one circuit comprises the prime mover while another circuit comprises means for heat transfer to the vaporizers forming the vapor coolant. The circuit comprising the prime mover, e.g., a turbine, has at the reactor exit a working pressure higher than the working pressure at the reactor exit of the circuit comprising the heat transfer means. The fuel elements to which the higher pressure is applied are provided with a cladding more resistant to pressure and heat than the cladding of the fuel elements placed in another circuit. These fuel elements provided with a high resistant cladding enclose suitably enriched nuclear fuel. (IIB)

10001 SHOCK ABSORBER. (to United Kingdom Atomic Energy Authority). French Patent 1,286,933. Jan. 29, 1962. Priority date Feb. 19, 1960, Great Britain.

A shock absorber especially adapted to be placed at the bottom of a vertical reactor channel comprises a male portion and a female portion. One of these portions is composed of a spaced piling of plates, while the other one is adapted to deform successively the borders of these plates. Afterwards it is liberated from these plates. (IIB)

10002 FUEL ELEMENT FOR NUCLEAR REACTORS. (to Sulzer Frères S. A.). French Patent 1,287,558. Feb. 2, 1962.

The fuel element consists of a pressure tube in which an assembly of canned fuel tubes, which are interconnected by means of common longitudinal fins, is mounted. The coolant is made to flow downwards through the channels formed by the fins and the tube walls and then upwards through the interior of the fuel tubes. (NPO)

10003 NUCLEAR REACTOR INSTALLATION. (to Sulzer Frères S. A.). French Patent 1,288,485. Feb. 12, 1962. Priority date May 17, 1960, Switzerland.

A nuclear reactor installation comprises a vapor-cooled reactor provided with pressure tubes enclosing the fuel elements. These pressure tubes are assembled in at least two groups, so that a fraction of the vapor leaving the pressure tubes of the first group serves for vaporizing a liquid medium in order to form the vapor coolant for the reactor, while another fraction therefrom is fed to the pressure tubes of a second group in order to be further superheated before it is led to the turbine. Preferably the pressure tubes of the first group are disposed in a central zone of the reactor, while the pressure tubes of the second group are disposed within a marginal zone of it. The fuel elements placed within the pressure tubes of the second group are provided with a cladding having a heat resistance higher than the heat resistance of the cladding of the other fuel elements. (IIB)

10004 PERIOD-METER FOR NUCLEAR REACTORS. (to Commissariat à l'Energie Atomique). French Patent 1,288,894. Feb. 19, 1962. Filed Feb. 16, 1961.

A period meter is described for a nuclear reactor of the kind comprising a logarithmic amplifier and a differentiating circuit associated with an auxiliary integrating circuit, both circuits utilizing the same amplifier with a high negative gain. The period meter has circuits for performing a supplementary integration so that low input signals of the circuit have a transient state sufficiently long in order to damp fluctuations of the signal, while for higher signals there is a relatively low damping which is a function of the speed of variation of the signal. Preferably the differentiating circuit has two inputs, each consisting of a condenser; the connection of the output of the logarithmic amplifier with the condensers is performed by the supplementary circuit comprising two branches respectively connecting the output of the logarithmic amplifier with one of the condensers, one branch transmitting only signals lower than a given value, while the other one transmits signals higher than said given value. (IIB)

10005 HIGH FLUX HOMOGENEOUS REACTOR WITH CIRCULATING FISSILE MATERIAL. Frank T. Barr and James F. Black (to Esso Research and Engineering Co.). U. S. Patent 3,050,454. Aug. 21, 1962.

The circulating fissile material in the reactor is maintained under sub-critical conditions except when in a defined nuclear reaction zone or core. The material is passed from the core through a cooling zone and is returned to the core. (R.J.S.)

10006 NEUTRON-FLUX GAGE FOR NUCLEAR REACTORS. Karl Janner (to Siemens-Schuckertwerke Aktiengesellschaft). U. S. Patent 3,050,624. Aug. 21, 1962.

A body of fissionable material is mounted in front of the

probe of a jacketed neutron-measuring gage to increase the sensitivity of the probe. (R.J.S.)

10007 FUSED REACTOR FUELS. S. W. Mayer (to U. S. Atomic Energy Commission). U. S. Patent 3,063.923. Nov. 13, 1962.

This invention relates to a nuclear reactor fuel composition comprising (1) from about 0.01 to about 50 wt.% based on the total weight of said composition of at least one element selected from the class consisting of uranium, thorium, and plutonium, wherein said element is present in the form of at least one component selected from the class consisting of oxides, halides, and salts of oxygenated anions, with components comprising (2) at least one member selected from the class consisting of (a) sulfur, wherein the sulfur is in the form of at least one entity selected from the class consisting of oxides of sulfur, metal sulfates, metal sulfites, metal halosulfonates, and acids of sulfur, (b) halogen, wherein said halogen is in the form of at least one compound selected from the class of metal halides, metal halosulfonates, and metal halophosphates, (c) phosphorus, wherein said phosphorus is in the form of at least one constituent selected from the class consisting of oxides of phosphorus, metal phosphates, metal phosphites, and metal halophosphates, (d) at least one oxide of a member selected from the class consisting of a metal and a metalloid wherein said oxide is free from an oxide of said element in (1); wherein the amount of at least one member selected from the class consisting of halogen and sulfur is at least about one at.% based on the amount of the sum of said sulfur, halogen, and phosphorus atom in said composition; and wherein the amount of said 2(a), 2(b) and 2(c) components in said composition which are free from said elements of uranium, thorium, and plutonium, is at least about 60 wt.% based on the combined weight of the components of said composition which are free from said elements of uranium, thorium, and plutonium. (AEC)

10008 INVERTED CONTROL ROD LOCK-IN DEVICE. William G. Brussalis and Glenn E. Bost (to U. S. Atomic Energy Commission). U. S. Patent 3,066,763. Dec. 4, 1962.

A mechanism which prevents control rods from dropping out of the reactor core in the event the vessel in which the reactor is mounted should capsize is described. The mechanism includes a pivoted toothed armature which engages the threaded control rod lead screw and prevents removal of the rod whenever the armature is not attracted by the provided electromagnetic means. (AEC)

10009 PROTECTED NUCLEAR FUEL ELEMENT. John Howard Kittel and James F. Schumar (to U. S. Atomic Energy Commission). U. S. Patent 3,067,116. Dec. 4, 1962.

A stainless steel-clad actinide metal fuel rod for use in fast reactors is reported. In order to prevent cladding failures due to alloy formation between the actinide metal and the stainless steel, a mesh-like sleeve of expanded metal is interposed between them, the sleeve metal being of niobium, tantalum, molybdenum, tungsten, zirconium, or vanadium. Liquid alkali metal is added as a heat transfer agent. (AEC)

10010 PROCESS FOR COOLING A NUCLEAR REACTOR. Lyle B. Borst (to U. S. Atomic Energy Commission). U. S. Patent 3,068,159. Dec. 11, 1962.

This patent relates to the operation of a reactor cooled by liquid sulfur dioxide. According to the invention the pressure on the sulfur dioxide in the reactor is maintained at least at the critical pressure of the sulfur dioxide. Heating the sulfur dioxide to its critical temperature results in vaporization of the sulfur dioxide without boiling. (AEC)

10011 METHOD AND APPARATUS FOR CONTROL OF A NUCLEAR REACTOR. William E. Cawley (to U. S. Atomic Energy Commission). U. S. Patent 3,068,161. Dec. 11, 1962.

A method and apparatus are described for controlling an overmoderated nuclear reactor containing columns of fuel elements aligned in a plurality of coolant tubes in a stream of coolant water. The invention includes means for adjusting the distance between halves of the fuel element column to vary the relative proportion of fuel and moderator at the center of the reactor. (AEC)

10012 METHOD AND MEANS FOR SUPPORTING REACTOR FUEL CONTAINERS IN AN ASSEMBLY. Edwin L. Currier, Jr., John H. Nicklas, and Chadwick A. Coombs (to U. S. Atomic Energy Commission). U. S. Patent 3,068,163. Dec. 11, 1962.

This patent relates to means for supporting fuel-containing tubes in an assembly which include grid means at either end of the fuel element assembly and improved grid means intermediate of the ends to provide support against lateral displacement. (AEC)

10013 IRRADIATION METHOD AND APPARATUS. Charles P. Cabell (to U. S. Atomic Energy Commission). U. S. Patent 3,069,337. Dec. 18, 1962.

A method and apparatus are described for changing fuel bodies into a process tube of a reactor. According to this method fresh fuel elements are introduced into one end of the tube forcing used fuel elements out the other end. When sufficient fuel has been discharged, a reel and tape arrangement is employed to pull the column of bodies back into the center of the tube. Due provision is made for providing shielding in the tube. (AEC)

10014 COMPOSITE ELEMENT. B. E. Schaner and R. A. Wolfe (to U. S. Atomic Energy Commission). U. S. Patent 3,069,338. Dec. 18, 1962.

Composite fuel elements of the sandwich type are reported. The invention resides in the use of a layer of graphite on the interfaces of the fissile material and the cladding to prevent interdiffusion of the fissile material and the cladding material. (AEC)

10015 NUCLEAR FUEL ELEMENT LEAK DETECTOR. Ivan M. Jacobs (to General Electric Co.). U. S. Patent 3,069,339. Dec. 18, 1962. Filed Aug. 13, 1958.

An apparatus is described for detecting and locating leaking fuel elements in a reactor core by monitoring the radioactivity of the effluent coolant from each fuel assembly or channel. A minimum of valving and reactor vessel penetrations are required. Efficiency of detection is enhanced by "integrating" the leakage over a period of time. (R.J.S.)

10016 HEAT EXCHANGE ARRANGEMENT FOR NUCLEAR POWER PLANT. Friedrich Flatt (to Escher Wyss Aktiengesellschaft). U. S. Patent 3,069,342. Dec. 18, 1962. Priority date Feb. 5, 1957, Switzerland.

A heat exchange arrangement is provided for transferring heat from a nuclear reactor to the working medium of a thermal power plant. The working medium flows serially through at least two heat exchange systems. Each system has a flow path for the medium under pressure leading through the reactor. The medium pressures in the two flow paths differ from one another, the temperature of the medium having the lower pressure being higher than that of the medium having the higher pressure. (R.J.S.)

10017 MODERATOR BLOCK CONSTRUCTION FOR NUCLEAR REACTORS. Roger Martin (to Commissariat à l'Energie Atomique). U. S. Patent 3,069,343. Dec. 18, 1962. Priority date Aug. 21, 1958, France.

Blocks of solid moderator material in a nuclear reactor are stacked in vertical columns. The blocks are keyed together and are provided with intercommunicating vertical ducts. (R.J.S.)

10018 COMPOSITE FUEL ELEMENT. W. J. Hurford, R. B. Gordon, and W. A. Johnson (to U. S. Atomic Energy Commission). U. S. Patent 3,069,527. Dec. 25, 1962.

A sandwich-type fuel element for a reactor is described. This fuel element has the shape of an elongated flat plate and includes a filler plate having a plurality of compartments therein in which the fuel material is located. The filler plate is clad on both sides with a thin cladding material which is secured to the filler plate only to completely enclose the fuel material in each compartment. (AEC)

10019 METHOD AND APPARATUS FOR DETERMINING THE STATE OF A NUCLEAR REACTOR. Basil M. Lide and Nyle E. Bush (to Westinghouse Electric Corp.). U. S. Patent 3,069,545. Dec. 18, 1962. Filed Feb. 28, 1958.

The design of a neutron flux measuring apparatus is set forth. Means for calibrating this apparatus are provided that do not require the use of externally impressed calibrating signals. (R.J.S.)

10020 NEUTRONIC REACTOR. Eugene P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 3,070,529. Dec. 25, 1962.

A reactor is described comprising a plurality of horizontal trays containing a solution of a fissionable material, the trays being sleeved on a vertical tube which contains a vertically-reciprocable control rod, a gas-tight chamber enclosing the trays, and means for conducting vaporized moderator from the chamber and for replacing vaporized moderator in the trays. (AEC)

10021 CONTROL APPARATUS FOR NUCLEAR REACTOR. Andre Huet. U. S. Patent 3,070,531. Dec. 25, 1962. Priority Date Feb. 14, 1957, France.

Simple mechanical systems are provided that permit one to obtain rapidly and precisely all possible variations of displacement of nuclear fuel bars with respect to each other. The basic arrangement consists essentially of a system of articulated quadrilaterals carrying the fuel bars of one row between them so that the spacing between the bars may be varied by a pull or thrust on the system. (R.J.S.)

10022 NUCLEAR FUEL ELEMENT LEAK DETECTOR. Edwin L. Zebroski (to General Electric Co.). U. S. Patent 3,070,532. Dec. 25, 1962. Filed May 13, 1958.

Radioactivity of the effluent coolant from each fuel assembly or channel in a reactor is monitored for the purpose of detecting and identifying leaking fuel elements. Efficiency of detection is enhanced by integrating the fission product leakage over a period of time. (R.J.S.)

10023 NUCLEAR REACTOR CORE SUPPORTING MEANS. Henry Shull Arms, Paul Heinz Walter Wolff, and Michael Rooney (to English Electric Co. Ltd. and Babcock and Wilcox Ltd.). U. S. Patent 3,070,533. Dec. 25, 1962. Priority date Aug. 20, 1957, Great Britain.

A number of interconnected cross members with an openwork assembly of strengthening members are employed to support a heavy core structure mounted with a pressure vessel. The openwork assembly allows a free flow of cooling gas. (R.J.S.)

10024 FUEL ELEMENTS. Lambert F. Kooistra (to Babcock and Wilcox Co.). U. S. Patent 3,070,534. Dec. 25, 1962. Filed Oct. 30, 1958.

A spacer is provided for use in a reactor fuel element which is disposed between and in parallel relationship with the fuel-containing components to maintain them in a regular geometric pattern. (R.J.S.)

10025 NUCLEAR REACTOR SAFETY DEVICE. Robert B. Spooner (to Koppers Co., Inc.). U. S. Patent 3,070,535. Dec. 25, 1962. Filed Jan. 21, 1959.

A device is described to be interposed between a high-temperature fuel element assembly and portions of a reactor to be protected. Damage to the reactor from an overheated fuel element assembly is prevented by the absorption of heat in the material of the device, which undergoes an endothermic reaction. (R.J.S.)

10026 PLANT INCLUDING NUCLEAR REACTOR. Anthony J. Taylor and Norman G. Worley (to Babcock and Wilcox Ltd.). U. S. Patent 3,070,536. Dec. 25, 1962. Priority date Aug. 29, 1958, Great Britain.

Means are described by which the coolant in a gas-cooled nuclear reactor, after being heated in the reactor, is arranged to heat a vapor generator and an economizer before being recirculated to the reactor. The object of this arrangement is to provide for modification of the effect of falling load on the temperature of coolant returning to the reactor. (R.J.S.)

10027 FUEL SUBASSEMBLY CONSTRUCTION FOR RADIAL FLOW IN A NUCLEAR REACTOR. Michael Treshow (to U. S. Atomic Energy Commission). U. S. Patent 3,070,537. Dec. 25, 1962.

An assembly of fuel elements for a boiling water reactor arranged for radial flow of the coolant is described. The ingress for the coolant is through a central header tube, perforated with parallel circumferential rows of openings each having a lip to direct the coolant flow downward. Around the central tube there are a number of equally spaced concentric trays, closely fitting the central header tube. Cylindrical fuel elements are placed in a regular pattern around the central tube, piercing the trays. A larger tube encloses the arrangement, with space provided for upward flow of coolant beyond the edge of the trays. (AEC)

10028 FUEL ASSAY REACTOR. Bernard I. Spinrad, Henry A. Sandmeier, and Frederick H. Martens (to U. S. Atomic Energy Commission). U. S. Patent 3,070,538. Dec. 25, 1962.

A reactor having maximum sensitivity to perturbations is described comprising a core consisting of a horizontally disposed, rectangular, annular fuel zone containing enriched uranium dioxide dispersed in graphite, the concentration of uranium dioxide increasing from the outside to the inside of the fuel zone, an internal reflector of graphite containing an axial test opening disposed within the fuel zone, an external graphite reflector, means for changing the neutron spectrum in the test opening, and means for measuring perturbations in the neutron flux caused by the introduction of different fuel elements into the test opening. (AEC)

10029 LINKS FOR GIRDLING A VERTICAL STACK OF MODERATOR UNITS IN A NUCLEAR REACTOR. Henri Correc (to Commissariat a l'Energie Atomique). U. S. Patent 3,071,528. Jan. 1, 1963. Priority date June 5, 1958, France.

A link for a horizontal girdle for use on the upper portion of a vertical moderator stack is designed which allows some moderator expansion in the horizontal direction. The link comprises a frame with inner and outer parallel plates,

a hinge member at each end of the frame, a hinge pin for each hinge member for hinging the frame to adjacent links, a plurality of spaced compression springs between the frame plates, and a bearing plate adjacent the inner plate for bearing against the stack. (D.L.C.)

10030 MECHANICAL HANDLING APPARATUS FOR LOADING AND UNLOADING HETEROGENEOUS NUCLEAR REACTORS. David R. Davies (to Associated Electrical Industries (Manchester) Ltd.). U. S. Patent 3,071,529. Jan. 1, 1963. Priority date Sept. 12, 1956, Great Britain.

A fuel element carrier is designed for transferring fuel elements to and from fuel channels. The carrier is located beneath the core and includes a magazine rotatable about a vertical axis, supports for fuel elements arranged in a circle about the axis, means for rotating the magazine step by step, and a pivoted loading arm for moving fuel elements vertically through the supports up through the channels. (D.L.C.)

10031 NEUTRONIC REACTOR. Stanley L. Koutz, Robert B. Duffield, Robert B. Minoque, William A. Compton, and Harriett R. Lynch (to General Dynamics Corp.). U. S. Patent 3,072,549. Jan. 8, 1963. Filed June 25, 1958.

A reactor has been designed for the production of radioactive isotopes. Specimens to be irradiated are placed in cups located in a rotatable ring. (R.J.S.)

10032 REACTOR SYSTEM AND CONTROL VALVE. Peter Fortescue, Corwin Rickard, and David Rose (to U. S. Atomic Energy Commission). U. S. Patent 3,072,550. Jan. 8, 1963. Filed Oct. 6, 1958.

Valves have been developed for controlling the flow of gaseous fluid through a passage or conduit. The valves have particular application in the cooling systems of gas-cooled reactors. (R.J.S.)

10033 FUEL ELEMENT INTERLOCKING ARRANGEMENT. Peter Fortescue and David Nicoll (to U. S. Atomic Energy Commission). U. S. Patent 3,072,552. Jan. 8, 1963.

This patent relates to a system for mutually interlocking a multiplicity of elongated, parallel, coextensive, upright reactor fuel elements so as to render a laterally self-supporting bundle, while admitting of concurrent, selective, vertical withdrawal of a sizeable number of elements without any of the remaining elements toppling. Each element is provided with a generally rectangular end cap. When a rank of caps is aligned in square contact, each free edge centrally defines an outwardly projecting dovetail, and extremitally cooperates with its adjacent cap by defining a juxtaposed half of a dovetail-receptive mortise. Successive ranks are staggered to afford mating of their dovetails and mortises. (AEC)

10034 NUCLEAR REACTOR. Chauncey Starr (to U. S. Atomic Energy Commission). U. S. Patent 3,072,553. Jan. 8, 1963.

This patent relates to a combination useful in a nuclear reactor and is comprised of a casing, a mass of graphite impregnated with U compounds in the casing, and at least one coolant tube extending through the casing. The coolant tube is spaced from the mass, and He is introduced into the space between the mass and the coolant tube. (AEC)

10035 RADIATION PROTECTION MEANS DURING THE EXCHANGE OF FUEL ELEMENTS. Kristian D. Madsen (to Allmanna Svenska Elektriska Aktiebolaget). U. S. Patent 3,072,554. Jan. 8, 1963. Filed Feb. 29, 1960.

Means are provided in a gas-cooled reactor for protection against radiation from fuel elements. Both the transport of spent elements to a pond and the loading of the reactor with new elements are considered. (R.J.S.)

10036 NUCLEAR PILES. Jacques Barth and Edouard Roche (to Societe Generale de Constructions Electriques and Mecaniques). U. S. Patent 3,072,555. Jan. 8, 1963. Priority date July 7, 1959, France.

An internal-boiling nuclear pile is described which allows drying and superheating of the saturated steam in the interior of the pile. (R.J.S.)

10037 REACTOR FUEL ELEMENTS TESTING CONTAINER. George Kirby Whitham and Richard R. Smith (to U. S. Atomic Energy Commission). U. S. Patent 3,073,767. Jan. 15, 1963.

This patent shows a method for detecting leaks in jacketed fuel elements. The element is placed in a sealed tank within a nuclear reactor, and, while the reactor operates, the element is sparged with gas. The gas is then led outside the reactor and monitored for radioactive Xe or Kr. (AEC)

10038 NUCLEAR REACTORS. Maurice Pierre André Moulin. (to Commissariat à l'Energie Atomique). U. S. Patent 3,073,771. Jan. 15, 1963. Priority date Mar. 18, 1957, France.

A device is designed for providing access to the channels of a reactor core for control and/or refueling. The device uses a hollow arm mounted in the access hole so that it is pivotable about a fixed point, and means is provided for sliding the pivoting arm along its longitudinal axis in order to introduce it into any of the channels whose outlets are directed toward the pivoting point. Thus, the number of orifices in the reactor shield can be reduced. (D.L.C.)

10039 METHOD OF OPERATING A NEUTRONIC REACTOR. Anthony Turkevich (to U. S. Atomic Energy Commission). U. S. Patent 3,074,868. Jan. 22, 1963.

This patent relates to one step in a method of operating a neutronic reactor consisting of a slurry of fissionable material in heavy water. Deuterium gas is passed through the slurry to sweep gaseous fission products therefrom and the deuterium is then separated from the gaseous fission products. (AEC)

10040 ALLOY COMPOSITION FOR NEUTRONIC REACTOR CONTROL RODS. B. Lustman, E. F. Losco, H. J. Snyder, and R. R. Eggleston (to U. S. Atomic Energy Commission). U. S. Patent 3,074 871. Jan. 22, 1963.

This invention relates to alloy compositons suitable as control rod material consisting of, by weight, from 65% to 85% Ag, from 2% to 20% In, from up to 10% of Cd, from up to 5% Sn, and from up to 1.5% Al, the amount of each element employed being determined by the equation $X + 2Y + 3Z + 3W + 4V = 1.4$ and less, where X, Y, Z, W, and V represent the atom fractions of the elements Ag, Cd, In, Al and Sn. (AEC)

Power Reactors

Refer also to abstract 8324.

10041 (AECL-1596) DOUGLAS POINT NUCLEAR GENERATING STATION. (Atomic Energy of Canada Ltd., Chalk River, Ont.). [nd.] 96p.

A detailed description of the Douglas Point generating station is presented. It is noted that this 200-Mw(e) station is being constructed to prove the economic feasibility of such generators and it is expected to establish costs on which firm estimates for later plants can be based. (J.R.D.)

10042 (AEEW-R-193) TIME OF FLIGHT NEUTRON SPECTRA MEASUREMENTS ON CORE 4 OF ZENITH.

F. R. Barclay and D. L. Reed (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Aug. 1962. 40p.

Neutron spectra in Core 4 of ZENITH were measured by means of a neutron chopper. Spectra were obtained at the core center at ambient temperature and at 375°C. (auth)

10043 (AGN-TM-398) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM DESIGN REPORT FOR AN IMPROVED ML-1 PRESSURE VESSEL. (Aerojet-General Nucleonics, San Ramon, Calif.). Sept. 1962. Contract AT(10-1)-880. 173p.

The design of the ML-1 pressure vessel and tube bundle, are reviewed. Possible improvements in corrosion resistance, stress concentrations, and fabricability are evaluated. A design incorporating tube-sheets with no internal cooling was developed, but was considered to be unacceptable for use in an ML-1 reactor. A conceptual design was completed for a near-optimum cooled tube-sheet which avoids the undesirable characteristics of the uncooled design and offers significant improvements to the ML-1 design in the areas of interest. Certain design improvements for pressure vessel components (other than the tube bundle) are also discussed. (auth)

10044 (CRARE-1108) HEAT TRANSFER AND FLUID DYNAMIC RESEARCH AS APPLIED TO FOG COOLED POWER REACTORS. J. G. Collier (Atomic Energy of Canada Ltd., Chalk River, Ont.). June 1962. 95p. (AECL-1631)

An up-to-date critical review is presented of the state of heat transfer and fluid dynamic research on two-phase gas/liquid systems as applied to the fog cooled power reactor concept. Detailed accounts are included of recent experiments with steam-water mixtures in complex geometries including 19 rod cluster assemblies. Areas where further research is required are mentioned. (auth)

10045 (CVNA-40) CAROLINAS-VIRGINIA TUBE REACTOR REFERENCE DESIGN II. (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Stone and Webster Engineering Corp., Boston). Dec. 16, 1959. For Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C. Contract [AT(30-1)-2289]. 273p.

The design of the Carolinas-Virginia Tube Reactor is described. Topics covered include: overall plant description, reactor design, primary coolant system, primary plant auxiliary systems, instrumentation and control, vapor container, auxiliary building, spent-fuel building, secondary plant facilities and services, electrical system, and site facilities. (M.C.G.)

10046 (CVNA-165) CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC. RESEARCH AND DEVELOPMENT PROGRAM QUARTERLY PROGRESS REPORT, JULY–SEPTEMBER 1962. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Contract [AT(30-1)-2289]. 23p.

Research and development progress is reported on the Carolinas-Virginia Tube Reactor. Topics covered include: project administration, evaluation of operation logs, primary coolant system pressure drops, reactor transients, radiation analysis, chemistry, thermal and hydraulic core tests, nuclear evaluation, ultrasonic inspection of pressure tubes, metallurgical examination of CVTR components, and hazards report. (M.C.G.)

10047 (DC-59-4-710) DATA REPORT—D102 A2 POWER PLANT TESTING–IET 13. Fred G. Devens (General Electric Co. Aircraft Nuclear Propulsion Dept., Idaho Falls, Idaho). Apr. 3, 1959. Contract AT(11-1)-171. 61p.

Pertinent test data obtained on the D102 A2 Power Plant at the Initial Engine Test Facility prior to the fuel element over temperature event on November 18, 1958, are presented. (auth)

10048 (DLCS-5001062) MONTHLY OPERATING REPORT [ON PWR OPERATION], OCTOBER 1962. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 52p.

Activities of the Shippingport Atomic Power Station are summarized. Topics covered include: operations, station performance, incidents, chemistry, health physics, refueling program, maintenance, test program, training program, and construction and major modification. (M.C.G.)

10049 (DLCS-5001162) MONTHLY OPERATING REPORT, NOVEMBER 1962. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 49p.

The Station operated at 80% reactor power under reduced reactor coolant temperature conditions until November 3, when the Station was shutdown due to average reactor coolant temperature decrease to 472°F, thus completing the end of the 80% power run with Seed 3. During the ensuing ten day period, testing of various equipment combinations was conducted with the generator output at 8 Mw gross. On November 13, the output was increased to 27 Mw until November 23, when Seed 3 power operation was terminated after having accumulated 7329 EFPH. The Station was then shutdown for the balance of November. Station cooldown was performed during the three day period following the shutdown, during which time the reactor pit was drained, and the reactor container dome was removed. Throughout the remainder of the month, operations were performed in support of the refueling program. There were no incidents during November. Specified water conditions were maintained in the Reactor Coolant System, Reactor Plant auxiliary systems and the boilers until the end of power operations on November 23. The boilers were drained November 25 in preparation for the annual state pressure vessel inspection. Although personnel radiation dosages were higher than normal during November due to the refueling operation, they were still within specified limits. Isolated instances of contamination occurred in the Reactor Plant but the areas and levels involved were small and the conditions were easily corrected. The refueling operation which began November 26 following the lifting of the reactor dome is described. The procurement and assembly of equipment as well as procedure preparation for refueling continued throughout November. The Test Program included the completion of nine of 14 tests performed during November; the remaining five were still in progress. The periodic review training program was offered to two operating personnel and one employee began Station Operator training. Acceptance testing of the HDS was terminated, but completion of minor design modifications continued; work on the Gas Bottle Storage Building was temporarily suspended. The modification of the 1A reactor coolant pump volute was begun. (auth)

10050 (GNEC-210(Suppl.2)) DESIGN AND FABRICATION OF THE BONUS REACTOR PRESSURE VESSEL. Supplement 2. J. F. Gibbons and A. S. Jameson, comps. (General Nuclear Engineering Corp., Dunedin, Fla.). Dec. 21, 1962. Contract AT(40-1)-2674. 83p.

The results of an experimental program to evaluate the effects of cladding defects on the fatigue life of the BONUS reactor pressure vessel are presented. The results of this program show the BONUS vessel, as manufactured, to have a fatigue life which is satisfactory for the service intended. Also included is a brief summary of the manufacturing

status of the BONUS vessel and a description of the closure leakage tests recently completed satisfactorily. A description of a re-evaluation of the maximum incident neutron flux on the vessel wall is contained in Section VI. This re-evaluation shows the level of integrated fast neutron flux at the vessel ID, to be 1.65×10^{19} nvt, as compared to the previously calculated maximum of 9.13×10^{18} nvt. This increase is due to changes in the core superheater which have occurred as the design evolved. Even with the higher level of fast flux, reactor operation will not be inhibited, since under normal operation the reactor vessel will not be pressurized to stresses greater than 20 per cent of the ASME Code allowable at temperatures less than 60°F above the 15 ft-lb Charpy V-notch transition temperature. (auth)

10051 (IDO-16807) ORGANIC REACTOR TECHNOLOGY QUARTERLY REPORT, APRIL 1–JUNE 30, 1962. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Oct. 15, 1962. Contract AT(10-1)-205. 107p.

The deposition of film was studied in irradiated circulating loops, in which both grounded and insulated plates were in the irradiated coolant volume; the purpose of these tests was to determine the effect on rate of film formation of charges generated on particulate matter or coolant molecules in the radiation field. Heavier deposits were found on the grounded plates and currents up to 30 microamp were measured flowing to this plate. Tests in the rocking cell showed that techniques are now available whereby this apparatus can be used with confidence to screen film-forming characteristics of coolant compositions. It was demonstrated that iron percarbide ($Fe_{20}C_9$) could be made under conditions comparable to those in the OMRE. It was made from an iron chelate by carbon monoxide reduction and emphasizes the possible importance of oxygen containing chelate in the transport of iron and deposition of film. The nature of the impurities occurring in commercial Santowax was examined and some highly colored, oxygenated material isolated. The hexaphenyls produced in irradiation of m- and p-terphenyls and in the reaction of polyphenyls with hydrogen atoms was studied. Further work was initiated in the area of synthesis of reference hexaphenyls, but synthesis of new candidate coolants also was continued. Areas under study included non-benzenoid heterocyclics, fused ring compounds, and hydrogen donor compounds. Partially hydrogenated fused ring structures, such as dihydrophenanthrene, continue to look very promising. Stabilizer studies were directed largely toward this area also, but the stabilizer program was brought to a close. The study of hydrocracking of high boiler was completed with a few additional catalyst tests. The treatment of unfractionated coolant was further developed and continued to look like the most desirable operation. Preliminary economic evaluations on the hydrocracking routes to reclamation were completed and looked attractive. Design liaison on the coolant technology and fuel technology loops and on loop handling equipment is nearing completion. Loop construction is about 13% completed. Overall completion of the basic EOCR was approximately 90% at the end of the reporting period. The out-of-pile Component Development Test Loop was operated for chem-pump testing with diphenyl-terphenyl eutectic fluid at temperatures up to 600°F. Methods of attaching thermocouples to fuel plates and of leading them out of the fuel assembly were studied. Both high temperature furnace brazing and resistance spot welding were used for attachment in these studies, and the brazing method was selected as the preferred method for attaching thermocouples to the instrumented fuel plates. A detailed study of the locations of the thermocouples was completed. The practicability of using ethylene glycol as a displacement cleaner of fuel elements was demonstrated. Studies on film formation from Santowax refluxed with chemically cleaned pipe sections indicated that the passivation film dissolves in the organic and increases the film deposit. This effect is eliminated by one refluxing with Santowax. Capsules for use in the MTR hydraulic rabbit facility were designed and built. These furnish heat by gamma absorption and permit organic samples to be irradiated at desired temperatures in a neutron field. An improved capsule for pyrolytic fouling was under test. Initial results were satisfactory and indicate that useful heat transfer data on the coolant may be an unexpected dividend from use of this apparatus. (auth)

10052 (IDO-16811) EOCR CONTROL ROD AND DRIVER FUEL HYDRAULIC TESTS. L. J. Harrison (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Oct. 19, 1962. Contract AT(10-1)-205. 105p.

The EOCR prototype control rod, control rod drive, and driver fuel assembly were extensively tested in 500°F Santowax and 132°F water. These tests not only established the operating characteristics of these assemblies but also revealed a number of deficiencies in the various components. The modifications required were tested to establish the satisfactory performance of the modified components. Flow versus pressure differential measurements were performed on the driver fuel and the control rod. These measurements were also performed on various sized orifices in both assemblies to facilitate final orifice sizing when the final physics and heat transfer calculations have been completed. Scram insertion time curves were obtained for a variety of control rod configurations and test conditions. These curves not only established the scram insertion reliability of the control rod but also provided the basis for performing a control rod force analysis. Included are descriptions of the control rod, control rod drive, and driver fuel assembly together with descriptions of their method of operation. (auth)

10053 (IDO-28592) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM MONTHLY PROGRESS REPORT FOR JULY 1962. (Aerojet-General Nucleonics, San Ramon, Calif.). Aug. 17, 1962. Contract AT(10-1)-880. 75p.

Development activities related to the Gas-Cooled Reactor Experiment and the ML-1 are reported. Information concerning development and operation of the Gas Turbine Test Facility is also included. The information is presented in sections on ML-1 engineering, operations, and fuel element development. Other sections are included containing information on the advanced program (GCRE) and the turbine test facility. (J.R.D.)

10054 (MND-M3A-2452) PM-3A NUCLEAR POWER PLANT PROGRAM FIFTH PROGRESS REPORT, AUGUST 16, 1961 TO FEBRUARY 15, 1962. (Martin-Marietta Corp. Aerospace Div., Baltimore). Contract AT(30-1)-2700. 98p.

The PM-3A reactor design characteristics, primary system design, secondary system design, and packaging are summarized. Plant design, core fabrication and testing, plant procurement and component fabrication, plant assembly, training, plant test program, plant disassembly and shipment, and plant installation are discussed. (M.C.G.)

10055 (NMI-7255) POWER REACTOR PROGRAM. Progress Report to Savannah River Operations Office, United States Atomic Energy Commission for the Period

September 1, 1962–September 30, 1962. S. Isserow, R. W. Anderson, and W. L. Larson (Nuclear Metals, Inc., Concord, Mass.). Oct. 31, 1962. Contract [AT(30-1)-1565]. 29p.

The program to develop components for heavy-water-moderated reactors was continued during the period. In other work, microstructural differences revealed in U-350 ppm Fe-900 ppm Al specimens by electron microscopy were correlated with differences in hot hardness. Additions of Si were found to affect the hardness of this alloy differently under various conditions. Precipitation and solid solution hardening were found to effect an increase in U hardness at Fe and Si contents of about 100 ppm. Fuel tubes were provided with brazed end closures of $\frac{3}{4}$ in. by precise positioning of the induction heating coil and careful input of power. (J.R.D.)

10056 (NP-12344(Vol. I)) HEAVY WATER MODERATED REACTORS EVALUATION STUDY. VOLUME I. SUMMARY AND CONCLUSIONS. (American Electric Power Service Corp., Dunedin, Fla. and General Nuclear Engineering Corp., Dunedin, Fla.). Oct. 15, 1962. 75p. (ECNG-1062(Vol. I))

Results of a study devoted primarily to the estimation of relative power generation costs for three basic types of D_2O reactors are presented. Power costs were estimated for a number of different situations corresponding to various economic and operating ground rules. A brief description is included of the pressurized heavy water reactor, the boiling heavy water reactor, and the gas-cooled heavy water reactor. A discussion of the future potential of each type is also included along with conclusions. (J.R.D.)

10057 (NP-12344(Vol.II)) HEAVY WATER MODERATED REACTORS EVALUATION STUDY. VOLUME II. DESIGN BASES AND PLANT COMPARISONS. (American Electric Power Service Corp., Dunedin, Fla. and General Nuclear Engineering Corp., Dunedin, Fla.). Oct. 15, 1962. 321p. (ECNG-1062(Vol.II))

Results of a comparative evaluation of large nuclear power plants employing pressure-tube heavy water reactors are presented. Ground rules for the study are presented along with detailed discussions concerning design philosophy, physics methods, and calculation examples. A comprehensive comparison of the 3 plants is also included in which a discussion is presented concerning the less obvious reasons for subtype differences. (J.R.D.)

10058 (NP-12344(Vol.III)) HEAVY WATER MODERATED REACTORS EVALUATION STUDY. VOLUME III. PLANT DESIGNS. (American Electric Power Service Corp., Dunedin, Fla. and General Nuclear Engineering Corp., Dunedin, Fla.). Oct. 15, 1962. 475p. (ECNG-1062 (Vol.III))

Detailed descriptions of a boiling heavy water reactor plant, a gas-cooled heavy water moderated reactor plant, and a pressurized heavy water reactor plant are presented. The information is given as a part of the comparative evaluation of large nuclear electric power generating plants. (J.R.D.)

10059 (SRO-76) HEAVY WATER POWER REACTOR PROGRAM MONTHLY PROGRESS REPORT, DECEMBER 1962. (Savannah River Operations Office, AEC). 10p.

The status of various research and development projects are outlined: CANDU reactor components, sintered aluminum products, heat transfer, zirconium, etc. The operation of the Heavy Water Components Test Reactor and the status of the Carolinas-Virginia Tube Reactor are described. (D.L.C.)

10060 (TID-11602) PRESSURE DROP EXPERIMENTS OF THE TITLE II FUEL ASSEMBLY FOR THE EXPERIMENTAL GAS COOLED REACTOR. SECTION III OF THE FUEL ASSEMBLY HEAT TRANSFER AND CHANNEL PRESSURE DROP EXPERIMENTS FOR THE EGCR RESEARCH AND DEVELOPMENT PROGRAM. W. H. Crandall and R. M. Higgins (Allis-Chalmers Mfg. Co. Atomic Energy Div., Washington, D. C.). Oct. 3, 1960. For [Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif]. Contract AT(10-1)-925. 54p. (RD-0009)

Data are presented on the pressure drop tests of the Title II fuel assembly design modification and refinements as occurred during the Title II test phase. All tests were conducted with the chosen 3.000-in. ID fuel assembly sleeve and with the outer six tubes of the seven-tube cluster located on a 2.000-in. dia bolt circle. The tests included two designs of spider support pieces and three designs of mid-length spacers. The pressure loss data are presented in the form of velocity head coefficients for the various components of inlet, full element length, exit, and the 14-in. center length over a range of Reynolds Numbers from 20,000 to 90,000. (auth)

10061 (TRG-Report-198) COMPUTER PROGRAMME DISCOUNT— FOR ESTIMATING COSTS OF ELECTRICITY AND PRICES OF PLUTONIUM FROM NUCLEAR POWER SYSTEMS. C. E. Iliffe (United Kingdom Atomic Energy Authority. Reactor Group, Risley, Lancs, England). Aug. 7, 1962. 68p.

A computer program, DISCOUNT, is described which can be used to calculate capacity build-up of nuclear power systems. The worth concept is used to obtain the cost of electricity and price of Pu from the system. The theoretical basis of the program is described and operating instructions including program checks are included. Data tape and printout formats are included. (J.R.D.)

10062 (UCRL-6473) PROPERTIES OF BeO CERAMICS AND THEIR APPLICATION IN A NUCLEAR PROPULSION SYSTEM (PLUTO). Albert J. Rothman (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 13, 1962. Contract W-7405-eng-48. 32p.

Air-breathing nuclear ramjet engines set rigid requirements on materials. One such nuclear reactor is Project Pluto. A typical reactor is portrayed and the reasons for ceramic materials requirements are given. A good neutron moderator is necessary for minimum frontal area (and hence drag). It must be refractory, resistant to oxidation at well above 1000°C in 300-psi air, and resistant to high thermal stresses. These requirements narrow the choice of materials considerably. Beryllium oxide is the logical choice of moderator, and $BeO-UO_2$ is the logical fuel element. The properties of BeO are considered in the light of the demands of such a system and compared generally with those of other oxides. Among the properties considered are strength, thermal stress resistance, and thermal conductivity. Some troublesome limitations are pointed out, e.g., reaction of BeO with water vapor, and oxidation susceptibility of UO_2. These in turn demand development of coatings to resist water attack and other components to stabilize the fuel against disruptive transformation. Some basic studies on BeO carried out in the laboratory in support of the program are described briefly, and references are given for their details. (auth)

10063 (WAPD-272) THE PYROLYTIC CARBON COATING OF CERAMIC FUEL FOR THE SECOND SHIPPINGPORT REACTOR CORE. L. J. Goetz and W. H. Britton (Westinghouse Electric Corp. Bettis Atomic

Power Lab., Pittsburgh). Nov. 1962. Contract [AT(11-1)-Gen-16]. 63p.

Fuel elements for the second Shippingport reactor core were fabricated by gas pressure bonding blanket (UO_2) and seed (UO_2–ZrO_2) fuel wafers into Zircaloy cladding components. To prevent reaction of the oxide fuel with Zircaloy during the bonding process, it was necessary to coat the fuel wafers with a thin inert barrier layer of pyrolytic carbon. The selection and development of processes for surface preparation, pyrolytic C coating, and accessory operations are described. Mechanical surface preparation, a rotating-bottle C coating process, and ultrasonic cleaning were used to produce adherent, clean pyrolytic C coatings on both seed and blanket fuel wafers. (auth)

10064 (WAPD-PWR-TE-65) OPERATIONAL INVESTIGATION OF NUCLEAR INSTRUMENTATION. Test Evaluation. Douglas M. Taylor (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Apr. 14, 1961. Contract [AT-11-1-GEN-14]. 135p.

Data are evaluated which were obtained during power and subpower operation in order to determine the capability of the nuclear instrumentation system to: indicate reactor transient behavior in the subpower range as established by the reactor kinetic equations; indicate reactor power level in the power range as established by calculated plant calorimetrics. The data came prior to, during, and immediately after the first approach to full power on PWR-1 Seed 2. (W.D.M.)

10065 (WAPD-PWR-TE-71) STEADY STATE PLANT PERFORMANCE DURING SEED-1 DEPLETION. Test Evaluation. Lawrence H. Kemmet and Douglas M. Taylor (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Jan. 20, 1961. Contract [AT-11-1-GEN-14]. 63p.

Data are presented for steady state tests which were performed during the 5806 EFPH lifetime of PWR-1 Seed-1. The tests covered the primary and secondary calorimetrics, main unit heat rate, nuclear signal linearity, heat exchanger, and main coolant pump performance. (D.L.C.)

10066 (WAPD-PWR-TE-74) CONTROL AND TRANSIENT PLANT RESPONSE DURING SEED-1 DEPLETION. Test Evaluation—DLCS-164; DLCS-167; DLCS-251. E. A. Wieczorkowski (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Dec. 29, 1960. Contract [AT-11-1-GEN-14]. 62p.

The dynamic response of the Shippingport plant to load-maneuvering operations is reported, and the effects of various plant conditions on these load swing transients are evaluated. The adequacy of the various plant control systems for reducing the magnitude of reactor plant transients is also illustrated. A corollary purpose of the evaluation was to compare the reactor plant response as observed during testing at Shippingport with analog simulation results. (auth)

10067 (WAPD-PWR-TE-78) NUCLEAR INSTRUMENTATION SOURCE RANGE DETECTORS. Test Evaluation (T-641329). DLCS-3150101, July 16–October 7, 1959. M. N. Palmer and O. D. Parr (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Mar. 23, 1961. Contract [AT-11-1-GEN-14]. 20p.

Tests were performed to obtain data for use in determining the cause of failures of the PWR BF_3 proportional counter elements. It was found that the failures are the result of leaks in the PWR Kovar-ceramic seals. Test data are included along with recommendations for remedial action. (J.R.D.)

10068 (WAPD-PWR-TE-92) FUEL ASSEMBLY FLOW RATES PWR CORE 1 SEED 2. Test Evaluation. Paul A. Bickel (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Apr. 4, 1961. Contract [AT-11-1-GEN-14]. 12p.

Eight combinations of reactor coolant pumps at fast speed were tested, and seed and blanket flow rates were monitored. Hot and cold leg loop temperatures, loop coolant flows, and reactor pressure were also measured. Seed 2 core region flow rates were within design flow. Erratic operation of the nozzle-type flowmeters in some of the blanket regions was noted. (D.L.C.)

10069 (WAPD-PWR-TE-95) PRIMARY COOLANT FLOW COASTDOWN IN PWR CORE 1. Test Evaluation. David L. Crum (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Apr. 3, 1961. Contract [AT-11-1-GEN-14]. 48p.

Tests were conducted to determine the flow coastdown characteristics of the primary coolant in PWR Core 1 (Seed 1 and 2) during loss of pumping power. Emphasis is on the behavior several seconds after pump shutdown. Data are presented in detail for the Seed 2 test results, while the Seed 1 results are treated briefly. (D.L.C.)

10070 (WAPD-T-1252) SYNTHETIC EXPERIMENTS FOR EVALUATING PERFORMANCE OF NUCLEAR REACTORS. A. C. Nelson, Jr., W. S. Minkler, and T. Shimamoto (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Aug. 1960. Contract [AT(11-1)-Gen-14]. 18p.

A series of design calculations on reactor performance is carried out on an IBM-704 computer for selected sets of values of the design variables. A method for evaluating the performance of a reactor is given, in which the performance characteristics are expressed as a function of several design variables by an approximating function. From this function, the probability of failure of the reactor to satisfy a particular design criterion may be estimated. (D.L.C.)

10071 (WAPD-T-1278) NONLINEAR EFFECTS IN XENON SPATIAL OSCILLATIONS. S. G. Margolis and S. Kaplan (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Feb. 1961. Contract AT(11-1)-Gen-14. 54p.

Xenon feedback can produce spatial oscillations in large power reactors. Depending on the reactor size, materials inventory, power, and temperature coefficient, these oscillations may be either transient or persistent. This phenomenon is treated by a modal analysis in which nonlinear terms are retained. The nonlinear effects are shown to limit the amplitude of the oscillation and to cause the position of the flux peak to precess azimuthally; a formula for calculating the limiting amplitude of the oscillation is derived and compared with analog computer results. (auth)

10072 (WAPD-T-1528) TIME-DEPENDENT FISSION-PRODUCT POISONS IN U-235 AND NATURAL URANIUM FUELS. M. R. Stuart and T. R. England (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1962. Contract AT(11-1)-Gen-14. 12p.

Fission-product poison in the core of the PWR seed-blanket reactor was calculated. The fission-product poison in U^{235} is compared with that of natural uranium and Pu^{239}. The effects of a power-dependent poison are described. The aggregate poison stability is discussed. The values of calculated and experimental poisons are compared. The re-

sults are based on explicit calculation of all known individual fission products which produce or lead to a significant poison. (M.C.G.)

10073 (WAPD-TM-330) EVALUATION OF THE PWR CORE 1 FAILED ELEMENT DETECTION AND LOCATION SYSTEM. C. S. Abrams, P. W. Frank, O. D. Parr, and F. R. Vaughn (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Nov. 1962. Contract AT(11-1)-Gen-14. 26p.

The Failed Element Detection and Location System of the Shippingport Atomic Power Station in the nuclear part of the plant monitors the effluent from individual core assemblies containing UO_2 fuel for certain radiochemical nuclides that identify defective fuel elements. The operational information obtained during the first 13,000 EFPH of Core 1 operation was used to evaluate the ability of the FEDAL System to detect and locate defected fuel elements. Analysis of these data indicated that, in different assemblies, there were at least two defective elements, a fact that was verified after removal of the elements from the core during a normal refueling operation. (auth)

10074 (WAPD-TM-337) PROPERTIES OF A HAFNIUM CONTROL ROD AFTER EXPOSURE DURING TWO SEED LIVES IN PWR CORE 1. G. J. Salvaggio, F. A. Nichols, and J. P. Bacca, Jr. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Nov. 1962. Contract AT(11-1)-Gen-14. 41p.

A PWR control rod irradiated to as high as 1×10^{22} nvt (>0.625 ev) during two seed lives in the Shippingport Atomic Power Station was destructively tested in an effort to determine the effect of irradiation on the properties of Hf and to further assess the consequences of abnormal corrosion of the weld joints of Zircaloy-2 welded to Hf. Tests performed included hardness, tensile post-irradiation corrosion, chemical analysis, and metallographic examinations. Results of these tests indicate that the strength increase follows a two-step process with an apparent saturation between 3.8 and 5.6×10^{21} nvt and an additional increase in strength at higher exposure, while the useful ductility decreases slightly. There are no apparent limitations of the control rods to further use arising from the observed corrosion at the weld joint, and short-time corrosion tests have not uncovered an acceleration of corrosion caused by buildup of transmutation elements. It is concluded, therefore, that Hf is adequate for continued use in PWR. However, further trends in property changes should be established by additional testing after each succeeding refueling. (auth)

10075 (WCAP-4128) CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CVTR PROJECT MONTHLY PROGRESS REPORT, AUGUST 1962. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Contract AT(30-1)-2289. 7p.

Progress is reported on post-construction research and development on CVTR. Topics covered include: primary system, reactor transients, radiation analysis, plant nuclear evaluation, ultrasonic inspection of pressure tubes, and metallurgical examination of CVTR components. (M.C.G.)

10076 (WCAP-4129) CVTR PROJECT, CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC. MONTHLY PROGRESS REPORT, SEPTEMBER 1962. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Contract AT(30-1)-2289. 6p.

Research and development progress is reported on the Carolinas-Virginia Tube Reactor. Topics covered include: primary system, reactor transients, radiation analysis, plant nuclear evaluation, and ultrasonic inspection of pressure tubes. (M.C.G.)

10077 STUDY OF THE CONTROL OF NUCLEAR POWER PLANTS. J. Fonteray and M. Rozenholc. Bull. Inform. Sci. Tech. (Paris), No. 61, 111-22(May 1962) (In French)

A study on the control of nuclear power plants was undertaken with respect to the EL-4 plant. Gas-cooled reactors are considered as the power source. The objectives of reactor control are tabulated, and regulation in a permanent regime is discussed. The methods used for control are then illustrated. (J.S.R.)

10078 PROBLEMS CONCERNING THE SAFETY OF GRAPHITE-MODERATED GAS-COOLED NATURAL URANIUM POWER REACTORS. J. Bourgeois, D. Costes, C. Henri, G. Lamiral, and Ch. Segot. Bull. Inform. Sci. Tech. (Paris), No. 63, 9-24(July 1962). (In French)

The safety of natural uranium power reactors, graphite-moderated and gas-cooled, depends on a number of factors. The most important of these are reviewed, and their relative significance in certain hypothetical accident conditions is estimated. After a brief outline of the intrinsic safety characteristics of the reactors considered, the precautions to be taken in the choice and employment of the various construction materials are indicated. The cases involving the two main types of accident (blocking of a channel and violent deflation) are studied in greater detail. The hypotheses and calculation methods used to determine the aerodynamic and thermal behavior, in various cases involving accidents, are developed, and the influence of the most important parameters is discussed. Some results are presented in the form of curves. (auth)

10079 SOME SAFETY PROBLEMS RELATIVE TO A REACTOR FITTED WITH PRESSURE TUBES. A. Meunier, R. Roche, and B. Vrillon. Bull. Inform. Sci. Tech. (Paris), No. 63, 31-42(July 1962). (In French)

The main safety problems in connection with a power reactor fitted with pressure tubes, heavy water moderated and cooled by CO_2 under pressure, are briefly set out. Special tests carried out in relation to safety studies on this type of reactor are described in particular detail; they concern the effects on the heavy water tank due to the sudden bursting of a pressure tube. (auth)

10080 CROSS LATTICE. P. Hamel (Hawker Siddeley Canada Ltd.). Can. Nucl. Technol., 1: No. 6, 28-30(1962).

A pressure-tube reactor concept is described in which each horizontal layer of parallel pressure tubes is rotated 90° around a vertical axis with respect to the horizontal layers above and below. It is proposed that this type of reactor has superior power-flattening characteristics, end-fitting design flexibility, coolant versatility, and engineering characteristics as compared with the all-tubes-parallel configuration. (T.F.H.)

10081 HWR-80 — "OFF-THE-SHELF" DESIGN FOR NUCLEAR POWER. Derek B. A. Chase (Canadian General Electric Co. Ltd., Peterborough, Ont.) Can. Nucl. Technol., 1: No. 6, 31-8(1962).

The characteristics of a natural-U-fueled heavy-water reactor (HWR-80), which is essentially a scale-up of the NPD reactor from 20 to 80 Mwe, are described. The HWR-80 is modified from the NPD by increasing the fuel rating, flux flattening in the core, adding fuel, and improving the steam-cycle efficiency. The economics of HWR-80 is discussed. The design data for HWR-80 are tabulated. (T.F.H.)

10082 IDEAS AND EXPERIENCES FOR A NUCLEAR POWER PLANT PROGRAM. Sergio Pittori. Comit. Nazl.

Energia Nucl., Notiziario, 8: No. 12, 76-82(Dec. 1962). (In Italian)

The drafting of a nuclear power plant construction program to meet requirements of the greatest economy are discussed. (auth)

10083 NUCLEAR DEVELOPMENT IN EASTERN GERMANY. Comit. Nazl. Energia Nucl., Notiziario, 8: No. 12, 95-7(Dec. 1962). (In Italian)

Nuclear activities carried out in Eastern Germany since 1955 are reported. (auth)

10084 150 MW CAPACITY ATOMIC POWER STATION WITH A VAPORIZING REACTOR, DESIGNED BY AEG. E. Moldoványi. Energia Atomtech., No. 3, 139-43(1962).

The most important features of the power station are described. (P.C.H.)

10085 POWER TESTS OF THE DIORIT REACTOR. G. Spinnler [(EPUL, Würenlingen, Switzerland)]. Neue Tech., 4: 432-40(Sept. 1962). (In French)

The modifications carried out in the reactor coolant circuits since it first went critical in 1960 are described. The various preparations for the experiments connected with the rise to full power are discussed, as well as the special measurements made on that occasion. The measured temperature distribution in the uranium corresponds exactly to the theoretical distribution. From this the magnitude of the temperature drop between the uranium and the can may be obtained. It is shown how the contact resistance, which corresponds to this drop, varies with the power and with the previous history of the fuel elements. A brief analysis of the various thermal phenomena limiting the reactor power show that DIORIT may be operated with a high degree of safety at 20 Mw and that the power could even be increased to 25 Mw. (auth)

10086 TEMPERATURE AND FLUX DISTRIBUTIONS IN THE DIORIT CORE. Z. J. Doron (Swiss Federal Inst. for Reactor Research, Würenlingen). Neue Tech., 4: 440-4 (Sept. 1962). (In English)

Temperature measurements at the outlet of each fuel channel of DIORIT enabled temperature maps to be drawn up. These served as a basis for flux maps of the core. The temperature and flux distributions are discussed with particular reference to control rod effects and hot spots. Measurement of the γ radiation emitted from a number of rods helped the above investigations. (auth)

10087 TEMPERATURE DISTRIBUTION IN THE DIORIT REFLECTOR AND IN THE SHIELDING (FIRST MEASUREMENT RESULTS). M. Klaentschi (Eidgenössische Technische Hochschule, Würenlingen, Switzerland). Neue Tech., 4: 444-8(Sept. 1962). (In German)

Steady state temperature distribution in the graphite reflector and the shielding are presented for the DIORIT reactor showing the temperature distribution to be asymmetric and the graphite temperature to be short of the foreseen target value of 200°C. Heating up and cooling down of the graphite are illustrated by means of two typical sets of graphite temperature data. (auth)

10088 THE MEASUREMENT OF THE TEMPERATURE COEFFICIENTS OF DIORIT. Z. J. Doron (Swiss Federal Inst. for Reactor Research, Würenlingen). Neue Tech., 4: 449-51(Sept. 1962). (In English)

The moderator and fuel temperature coefficients were measured both in the clean and in the xenon poisoned core of DIORIT. The various methods used for these measurements are discussed. The temperature coefficients were found to be negative and larger for the poisoned than for the clean core. This is discussed in connection with the manner in which the Xe-135 absorption cross section changes with energy. (auth)

10089 SPECIAL PROBLEMS OF MONITORING OF FUEL ELEMENT CLADDING. H. Flury (Eidgenössische Technische Hochschule, Würenlingen, Switzerland). Neue Tech., 4: 452-7(Sept. 1962). (In German)

The burst slug detection system of DIORIT is described in short. The measurements to determine the background activity of the helium are discussed, and it is shown that this activity is due to O^{19} and Ar^{41}. In order to increase the detection sensitivity a new detector was built, in which the precipitation volume is swept with inactive helium before each measurement. The sensitivity of the modified system was tested with a UO_2 sample and the smallest detectable surface was established as 0.33 cm^2 of UO_2. (auth)

10090 EFFICIENCY OF THE DIORIT SHIELDING. J. M. Pictet [(EPUL, Würenlingen, Switzerland)]. Neue Tech., 4: 458-60(Sept. 1962). (In French)

After having given some references concerning the lay-out of the DIORIT shielding, the author summarizes briefly the methods of computation in designing the thickness of the DIORIT shieldings. As these methods are applicable for idealized geometries only, it is necessary to incorporate approximations which take into account the effective set up. Test results of the radiation doses as measured for the lateral shielding and for the upper DIORIT platform are listed and compared to the predicted ones; the radiation doses as measured in the basement are listed also. Some particular problems, especially concerning the upper chamber of the reactor, are briefly analyzed. (auth)

10091 CALIBRATION OF NEUTRON ABSORBING REGULATING ORGANS IN DIORIT. H. Albers, Z. J. Doron, and T. Gozani (Swiss Federal Inst. for Reactor Research, Würenlingen). Neue Tech., 4: 461-5(Sept. 1962). (In English)

The methods and results of the control rod calibration in the heavy water reactor DIORIT are given. The various techniques used, namely period measurement, rod-oscillation, quasi-homogeneous poisoning, xenon poisoning, and the source jerk technique are compared. Differences in the results are discussed and the best values for the worth of the control rods are given. (auth)

10092 SOME REFLECTIONS WITH RESPECT TO THE GROUP OPERATING A NUCLEAR POWER PLANT. R. Beck [(EPUL, Würenlingen, Switzerland)]. Neue Tech., 4: 466-9(Sept. 1962). (In French)

Having considered three types of nuclear stations, the reactor operation group of DIORIT at the Swiss nuclear center at Würenlingen (AG) is described. A more personal point of view about such an organization is then explained. (auth)

10093 FAST REACTORS, A WORLD SURVEY. Nucl. Power, 7: 42-9(Dec. 1962).

A survey of work on fast breeder reactors is presented to further interest in future power and electricity generation by these reactors. Reasonably up-to-date information on work in France, Belgium, West Germany, Italy, Japan, Sweden, UK, USA, and USSR is given in addition to a chart of reactors. (D.C.W.)

10094 ENGINEERING PROBLEMS WITH THE DRAGON REACTOR. G. Coast. Nucl. Power, 8: No. 81, 38-43(Jan. 1963).

A review is given of the friction, lubricant, and bearing problems encountered in the Dragon (High Temperature Gas Cooled Reactor Experiment) reactor. Temperatures of 1000 to 1500°C are met in this reactor. (T.F.H.)

10095 ECONOMICS OF HEAVY-WATER REACTORS. Daniel S. St. John and James W. Wade (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nucleonics, 20: 52-5 (Dec. 1962). (TID-17081)

Because of its inherently low fuel cost, the heavy-water reactor promises to overtake light-water designs in economic competition within the United States as the demand grows for larger power plants and the price of heavy water falls. (auth)

10096 SHIELDING CVTR–A HEAVY-WATER PRESSURE-TUBE REACTOR. Stefan S. Pawlicki (Westinghouse Atomic Power Div., Pittsburgh). Nucleonics, 20: 74-8; 80; 82(Dec. 1962).

Design of the radiation shields for heavy-water pressure-tube reactors involves problems not encountered with light-water-cooled reactors that employ a pressure vessel. Radiation can stream through the numerous shield penetrations for the pressure tubes, and the thin tank wall puts the thermal-shielding burden on shield slabs mounted outside the vessel. Because of the high cost of heavy water, it is important to avoid risks of degrading D_2O with H_2O; thus designers prefer not to use a light-water shield over the core during refueling. However, heavy water does not slow down or absorb neutrons as effectively as light water does. The CVTR typifies these problems and the methods that can be used to solve them. (R.J.S.)

10097 USING PLUTONIUM IN FAST REACTORS. Harry H. Hummel, Milton Levenson, Leonard E. Link, Robert E. Machery, and Wallace R. Simmons (Argonne National Lab., Ill.). Nucleonics, 21: No. 1, 43-7(Jan. 1963).

Potential high breeding gain makes plutonium-fueled fast reactors particularly promising for economic power production. But cross-section uncertainties and safety considerations still require careful experimentation. (auth)

10098 DYNAMIC PROGRAMMING OPTIMIZATION OF NUCLEAR-REACTOR OPERATING CONDITIONS. Kermit L. Garlid and William I. Neef (Washington Univ., Seattle). Trend Eng. Univ. Wash., 14: No. 4, 24-7(Oct. 1962).

Economic optimization of power reactors by means of the dynamic programming method is described. The operation is divided into three major stages: pre-irradiation handling, preparation, and processing of the fuel; fuel irradiation at arbitrary, variable power levels, and charging and discharging of the fuel at the reactor; and post-irradiation storage, separation, and chemical operations on the fuel elements. The performance of an IBM-709 program (HANDY-1) in carrying out the required calculations is discussed. Relations are shown between the power level, fuel irradiation exposure, and Pu recovery rates. (T.F.H.)

10099 HEAVY WATER MODERATED NATURAL URANIUM POWER REACTORS. J. L. Gray, G. A. Pon, G. J. Phillips, and D. B. Primeau (Atomic Energy of Canada Ltd., Chalk River, Ont.). 1962. 34p. (AECL-1646)

Paper from Sixth World Power Conference, Melbourne, Oct. 20-27, 1962.

The CANDU reactor is described. Several improvements are evaluated. Use of pressure tube systems with better reactor economy could provide a saving of 0.1 mill/kwh. Bulk boiling in the coolant channels could result in a saving of 0.2 mill/kwh. D_2O cost-decrease savings of the order of 0.15 to 0.2 mill/kwh are probable. Significant reductions in unit energy cost (0.8 mill/kwh) result from the building of two-unit stations, or single-unit stations of greater output. The potential of a CANDU type reactor of size intermediate between CANDU and NPD is assessed by uprating the NPD design to approximately four times its present electrical output. The estimated cost of power from an uprated NPD is competitive with that of other reactor systems. The use of alternative coolants, such as organics or wet steam in 200 Mw(e) natural-uranium heavy-water-moderated reactors offers opportunities for further savings in the long term. (auth)

10100 CONTROL AND TRANSIENT PERFORMANCE RWE NUCLEAR POWER PLANT, KAHL, GERMANY. M. A. Head (General Electric Co., San Jose, Calif.). AIEE Preprint Paper No. CP 62-1471. Prepublication Copy. 45p. $1.00.

Four tests of control and transient performance of the RWE plant carried out between June 1961 and January 1962 are described. In the plant load control test the plant responded well to all disturbances; it was overdamped and easy to control. The control rod withdrawal test demonstrated that a four-rod withdrawal accident could be safely terminated by the reactor safety system. The reactor pressure transient test determined the dynamic relationship between reactor power and pressure. The automatic control system was tested and judged ready for normal operational duty. (A.G.W.)

10101 ELECTRICAL FEATURES OF THE SELNI ENRICO FERMI ATOMIC POWER PLANT. G. d'Arminio, B. H. Axelson, L. Agnes, and J. R. Hulley. AIEE Preprint Paper No. CP 62-1451. Prepublication Copy. 30p. $1.00.

The Enrico Fermi Power Plant, a pressurized-water-moderated and -cooled reactor of advanced concept and design, is under construction on the northern bank of the Po River in Italy. A general description of plant design and arrangement is followed by a more detailed description of the plant electrical supply systems. Design features related to reactor safety and control are discussed. (A.G.W.)

10102 NONNUCLEAR TESTING AT THE ENRICO FERMI ATOMIC POWER PLANT. Robert W. Hartwell (Power Reactor Development Co., Detroit). ASME Preprint Paper No. 62-PWR-4. New York, American Society of Mechanical Engineers, 1962. Prepublication Copy. 19p. $1.00.

Systems and components are undergoing extensive pre-operational testing and necessary adjustments and modifications are being made. The Fermi Plant utilizes a fast neutron breeder reactor of 100 Mw(e) capacity designed to produce about 20% more new nuclear fuel in the form of plutonium than it uses in the form of U-235. During the testing program and during the final periods of construction, delays were encountered which involved the installation of systems and, in some cases, the replacement of equipment. (auth)

10103 THE REACTOR AND PLANT DESIGN FOR THE ESADA EVESR. John Barnard (General Electric Co., San Jose, Calif.). Preprint Paper No. 61-WA-223. New York, The American Society of Mechanical Engineers, 1962. 16p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 26-Dec. 1, 1961.

The design of a nuclear testing reactor and plant to be used in the development of superheat reactor fuel elements is described and the background of the project is reviewed. The details of the reactor design and the containment structure are described. The future connections to and the planned operation of the superheating reactor with the Vallecitos boiling-water reactor and its turbine generator are discussed. (auth)

10104 CENTRAL STATION BWR NUCLEAR POWER PLANT. Robert H. Shannon and George M. Roy (General Electric Co., San Jose, Calif.). Preprint Paper No. 62-WA-327. New York, The American Society of Mechanical Engineers, 1962. 25p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 25-30, 1962.

A description is given of the BWR nuclear power plant which is offered to the utility industry with the following specific warranties: plant performance for complete plants on prime contract basis, nuclear steam system performance where NSSS only is furnished, and fuel performance. (R.J.S.)

10105 TESTING AND INITIAL OPERATION OF THE NS SAVANNAH. J. H. MacMillan (Babcock and Wilcox Co., Lynchburg, Va.). Preprint Paper No. 62-WA-310. New York, The American Society of Mechanical Engineers, 1962. 18p. $1.00.

Paper from Winter Annual Meeting, New York, Nov. 25-30, 1962.

Some of the significant technical results of the testing and initial operation of the world's first nuclear-powered merchant ship, NS Savannah, are presented. Brief summaries of design data, the scope of the test program, and its objectives and chronology are given as background for the reporting of the test results and operating characteristics. (R.J.S.)

10106 TOUR OF THE U.S.S. "ENTERPRISE" AND REPORT ON JOINT AEC-NAVAL REACTOR PROGRAM. HEARING BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SEVENTH CONGRESS, SECOND SESSION, MARCH 31, 1962. (United States. Congress. Joint Committee on Atomic Energy). 62p. (GPO)

10107 ELECTRICAL SYSTEM FOR THE PEACH BOTTOM ATOMIC POWER STATION. K. M. Bausch (Bechtel Corp., San Francisco) and C. B. Wagner. Preprint Paper No. CP 63-204. New York, The Institute of Electrical and Electronics Engineers, 1963. 15p. $1.00.

Paper from Winter General Meeting, New York, Jan. 27-Feb. 1, 1963.

Salient features of the electrical system for the Peach Bottom nuclear power plant include a variation on the normal unit transformer scheme, effective application of the principle of duality for enhanced reliability of essential auxiliaries, and a unique utilization of main turbine generator coastdown power for emergency shutdown cooling. Peach Bottom is the prototype plant for the High-Temperature Gas-Cooled reactor concept, which attains modern steam conditions of 1450 psi and 1000 F. (auth)

10108 ECONOMIC FACTORS IN THE SAXTON ELECTRICAL DESIGN. R. E. Frick (Gilbert Associates, Inc., Reading, Penna.). Preprint Paper No. CP 63-154. New York, The Institute of Electrical and Electronics Engineers, 1963. 9p. $1.00.

Paper from Winter General Meeting, New York, Jan. 27-Feb. 1, 1963.

The design objectives are stated and the ways and means of minimizing the cost of the various electrical systems are discussed for the Saxton Nuclear Power project. Plant and equipment layout is reviewed from the viewpoint of the electrical engineer. Descriptions are included of electrical system design details and economies, equipment and material selections, and containment vessel cable penetration designs. Finally, the electrical requirements imposed by the experimental program are described. (auth)

10109 CONTROL POWER SUPPLY FOR THE INDIAN POINT NUCLEAR POWER PLANT. J. G. Noest (Consolidated Edison Co. of New York, Inc., New York), J. W. Skooglund, and R. E. Giboney. Preprint Paper No. CP 63-297. New York, The Institute of Electrical and Electronics Engineers, 1963. 10p. $1.00.

Paper from Winter General Meeting, New York, Jan. 27-Feb. 1, 1963.

The design of an a-c and d-c control power supply for a nuclear plant is discussed with emphasis on reliability and continuity of service. A motor-generator set operating from the d-c battery can maintain a-c power after total loss of external supply. Static control systems regulate a-c voltage and frequency within ±1 per cent and ±½ per cent, respectively, under all load conditions. (auth)

10110 ELECTRICAL AUXILIARY POWER SYSTEM FOR THE PIQUA NUCLEAR POWER FACILITY. J. Marvosh and A. M. Stelle (Atomics International, Canoga Park, Calif.). Preprint Paper No. CP 63-197. New York, The Institute of Electrical and Electronics Engineers, 1963. 7p. $1.00.

Paper from Winter General Meeting, New York, Jan. 27-Feb. 1, 1963.

The rigid safety regulations required in nuclear power facilities impose the need for a highly reliable electrical auxiliary power system. To meet the need for reliability and safety, an emergency power system supplies electrical power to vital plant components in case of failure of the normal power supply. The normal power system supplies electricity from the Piqua Power Station to all plant auxiliary equipment at 4160 V, 480 V, 120/208 V a-c, and 250 V d-c. The emergency power system supplies electricity at 480 V a-c and 250 V d-c, from a Diesel-driven alternator and from storage batteries, to all the critical components which must remain in operation for protection and safety of the nuclear plant. Relays and interlocks are provided to obtain a smooth transition from normal to emergency power and vice versa. Sensitive electronic control equipment is supplied with noise-free power at 120/208 V a-c from an inertially stabilized motor-alternator set energized from the 250 V d-c bus. (R.J.S.)

10111 HALLAM NUCLEAR POWER FACILITY ELECTRICAL AUXILIARY POWER SYSTEMS. V. R. Pool (Atomics International, Canoga Park, Calif.). Preprint Paper No. 63-209. New York, The Institute of Electrical and Electronics Engineers, 1963. 7p. $1.00.

Paper from Winter General Meeting, New York, Jan. 27-Feb. 1, 1963.

The electrical auxiliary power systems in a sodium-cooled graphite moderated nuclear reactor (SGR) are described. Reliability requirements and methods of achieving them are discussed. Sodium system preheating, which is a requirement unique to sodium-cooled reactors, is outlined. Nuclear instrumentation electrical noise problems, and how to avoid them, are included. Auxiliary power requirements of a 360 mwe SGR plant are compared with those of a similar conventional plant. The HNPF has a nominal rating of 240 mwt (thermal megawatts) with a calculated net output of 75 mwe (electrical megawatts). The electrical station auxiliaries are serviced by three voltage levels: 4160v, 480v, and 120/208v. Uninterrupted auxiliary power is of prime importance in the operation of a nuclear reactor, and for this reason all auxiliary power systems were designed to provide a maximum of reliability. A power interruption of only a few cycles duration is enough to scram the reactor. A reactor scram is accompanied by a turbine trip, so a

scram must be avoided except when absolutely necessary. (R.J.S.)

10112 NUCLEAR REACTOR. (to Deutsche Gold-Und Silber-Scheideanstalt Vormals Roessler). British Patent 911,458. Nov. 28, 1962. Priority date June 13, 1958, Germany.

A reactor is described which avoids the need for fuel-coolant contact by effecting heat transfer through radiation. The reactor is similar to a high vacuum furnace in that the fuel is enclosed within a boiler having a system of cooling coils on its exterior. Some of the advantages of the reactor are: the fuel can be in the molten state and need not be canned, and fission products can escape from the fuel. (D.L.C.)

10113 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Babcock and Wilcox Co.). British Patent 913,653. Dec. 19, 1962. Priority date Jan. 31, 1958, United States.

A convertor reactor of the pressurized water type is designed. Control is effected by control rods and burnable and soluble poison within the core. The core is divided into two fuel concentration zones. The reactor characteristics are tabulated in detail. (D.L.C.)

10114 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Babcock and Wilcox Co.). British Patent 913,655. Dec. 19, 1962. Priority date Mar. 14, 1958, United States.

A pressurized-water reactor is designed with an economical control system. Control is effected by means of soluble poison (boric acid) in the coolant and boron dispersed in amounts of 500 ppm in the stainless steel clad of the fuel, in addition to the conventional control rods, which are used for fast reactivity changes. The reactor core is divided into two zones, the outer zone having a higher content of fissile material than the inner zone. (D.L.C.)

10115 IMPROVEMENTS RELATING TO NUCLEAR FUEL ELEMENTS. (to Babcock and Wilcox Co.). British Patent 913,657. Dec. 19, 1962. Priority date Mar. 25, 1959, United States.

A fuel element assembly with an improved end enclosure is designed for pressurized water reactors. The assembly comprises a casing containing a fuel rod bundle and forming a coolant flow channel. At one end of the casing, an internal, removable closure member penetrated by a nozzle is provided with locking means. A compression spring is used to keep the closure member in the locked position. (D.L.C.)

10116 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENT ASSEMBLY FOR NUCLEAR REACTORS. (to Babcock and Wilcox Co.). British Patent 913,658. Dec. 19, 1962. Priority date Apr. 17, 1959, United States.

A fuel element assembly, comprising a bundle of fuel pins extending lengthwise of the assembly, is designed for pressurized water reactors. In the assembly, the content of fissionable material in the outermost pins is lower than the average content in all the pins to prevent their premature burning out due to the higher neutron flux at the edges of the assembly. Short annular spacers are provided between the pins to reduce distortions due to bowing. (D.L.C.)

10117 INSTALLATION FOR THE PRODUCTION OF SUPERHEATED STEAM IN A NUCLEAR REACTOR. (to Brown, Boveri and Cie. A. G.). French Patent 1,239,599. July 18, 1960. Priority date June 6, 1959, Germany.

An installation for the production of superheated steam comprises a nuclear reactor provided with cylindrical fuel element cells. Each cell encloses nuclear fuel and has a marginal region in which heat at the temperature of the saturated vapor of a working fluid is produced, while the heat for superheating the vapor is produced in a central region of the cell. Suitably the nuclear fuel is constituted of a cylindrical fuel element so that the marginal region encloses the fuel element, while the inside constitutes the central region. According to an improved embodiment the working fluid itself passes in a first cycle directly through the marginal region, while the same or another fluid passes in a second cycle successively through the central region and through heat transfer means, e.g., a heat exchanger adapted to transfer the heat from the second cycle to the first cycle for superheating the working fluid. (IIB)

10118 NEUTRONIC REACTOR. Farrington Daniels (to U. S. Atomic Energy Commission). U. S. Patent 3,069,341. Dec. 18, 1962.

A power plant is described comprising a turbine and employing round cylindrical fuel rods formed of BeO and UO_2 and stacks of hexagonal moderator blocks of BeO provided with passages that loosely receive the fuel rods so that coolant may flow through the passages over the fuels to remove heat. The coolant may be helium or steam and flows through at least one more heat exchanger for producing vapor from a body of fluid separate from the coolant, which fluid is to drive the turbine for generating electricity. By this arrangement the turbine and directly associated parts are free of particles and radiations emanating from the reactor. (AEC)

10119 NEUTRONIC REACTOR POWER PLANT. Herbert E. Metcalf (to U. S. Atomic Energy Commission) U. S. Patent 3,070,530. Dec. 25, 1962.

This patent relates to a nuclear reactor power plant incorporating an air-cooled, beryllium oxide-moderated, pebble bed reactor. According to the invention means are provided for circulating a flow of air through tubes in the reactor to a turbine and for directing a sidestream of the circulating air through the pebble bed to remove fission products therefrom as well as assist in cooling the reactor. (AEC)

10120 NUCLEAR REACTOR. Gale Young (to U. S. Atomic Energy Commission). U. S. Patent 3,071,527. Jan. 1, 1963.

This patent covers a power-producing nuclear reactor in which fuel rods of slightly enriched U are moderated by heavy water and cooled by liquid metal. The fuel rods arranged parallel to one another in a circle are contained in a large outer closed-end conduit that extends into a tank containing the heavy water. Liquid metal is introduced into the large conduit by a small inner conduit that extends within the circle of fuel rods to a point near the lower closed end of the outer conduit. (AEC)

Production Reactors

10121 (HW-64972) SEALING MATERIALS FOR PRTR STRUCTURAL OPENINGS. H. L. Floyd (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 29, 1960. Contract [AT(45-1)-1350]. 11p.

Sealing materials for a rectangular duct in the PRTR containment vessel for electric service and instrument lines were tested. A two-part epoxy adhesive that hardens in about 24 hr was found to be satisfactory when poured on a sand base used to fill the duct. Silicone foam and fiberglass resin compounds were found to be less effective. Paraffin and asphalt compounds were unsatisfactory. (M.C.G.)

10122 TEMPERATURE PREDICTION AND CONTROL IN PRODUCTION REACTORS. R. M. Horsley, D. S. Briggs, and J. A. Enderby (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). Nucl. Power, 7: 55-60 (Dec. 1962).

Computer calculations predict a representative flux and temperature for each channel of the Calder Hall reactors. Comparison with measured values (graphs) reveals good agreement. Computer calculations have revealed optimum absorber patterns, helping to increase power output, and are now incorporated in new temperature criteria for the reactors. (D.C.W.)

10123 UTILITY PROPOSAL FOR POWERPLANT ADDITION TO HANFORD NEW PRODUCTION REACTOR. (United States. Congress. Joint Committee on Atomic Energy). July 1962. 132p. (GPO)

The principal documents are included concerning a proposal submitted by the Washington Public Power Supply System to the Atomic Energy Commission and the Bonneville Power Administration for the construction and operation of an electric generating plant at Hanford, Washington, which would use the byproduct steam generated in the Commission's new production reactor (NPR) now under construction. (R.J.S.)

Research Reactors

10124 (ANL-6616) DESIGN SUMMARY REPORT ON THE JUGGERNAUT REACTOR. J. R. Folkrod, G. Ember, W. Kolb, J. Saluja, and D. P. Moon (Argonne National Lab., Ill.). Sept. 1962. Contract W-31-109-eng-38. 128p.

A detailed design summary is presented for the Juggernaut, a water-cooled and -moderated thermal 250-kw(th) reactor for neutron flux studies. Among the items discussed are the core, experimental facilities, instrumentation, etc. A cost analysis is given. (D.L.C.)

10125 (BNL-6160) FACILITY AVAILABILITY—BROOKHAVEN GRAPHITE RESEARCH REACTOR. Period Covered, January 1951–March 1962. Dudley Thompson (Brookhaven National Lab., Upton, N. Y.). [May 15, 1962]. Contract [AT(30-2)-Gen-16]. 10p.

A comparison of the use of experimental facilities at the Brookhaven Graphite Research Reactor for February 1952 and February 1962 showed a consistently satisfactory usage. The reactor is operated on a three-week cycle, with scheduled shutdowns every third Thursday and Friday. It was found that the relative times involved in shutdown requirements are about equal for work on experiments and for operational maintenance and service. The overall performance record revealed an 84.3% up time, with an operational availability of 92.18%. (M.C.G.)

10126 (CRDC-1126) RADIOACTIVITY IN THE NRX HEAVY WATER. W. J. Edwards and R. C. Hawkings (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nov. 1962. 22p. (AECL-1653)

A study of the various γ-emitting radionuclides in the NRX heavy water system was carried out. Twelve γ-emitters were found in the heavy water moderator system of the NRX reactor and their concentrations were measured. These were Al^{28}, Mn^{56}, Na^{24}, W^{187}, Ba^{140}, Cr^{51}, Zr^{95}, Nb^{95}, Sb^{124}, Ce^{141}, Ru^{103}, and Co^{60}. The longer-lived emitters collected by the ion-exchange column were also identified and the quantities on the column determined. These nuclides were Ba^{140}, Cr^{51}, Sb^{124}, Ce^{141}, Co^{60}, and Ru^{103}. An unexpected distribution of activity on the ion-exchange column was found when compared with that in the heavy water, on the basis of simple assumptions. A brief qualitative explanation of this observation is given in terms of a competition (for each nuclide) between the ion-exchange resin and the fine alumina dispersion in the heavy water. Some comments on the shielding requirements for heavy-water purification columns are included. (auth)

10127 (DP-795) HEAVY WATER MODERATED POWER REACTORS. Progress Report, October 1962. L. Isakoff and H. F. Measley (Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.). Nov. 1962. Contract AT(07-2)-1. 39p.

The Heavy Water Components Test Reactor (HWCTR) was started up with test fuel elements. A new design of driver elements was proposed for use in later loads of HWCTR to obtain more severe thermal conditions than can be obtained in the test elements with the current design of driver tubes. Additional measurements of heat transfer burnout in annuli and tubes containing boiling water at 1000 psia were made. (auth)

10128 (HW-74731) IN-REACTOR MONITORING OF ZIRCALOY-2 PRTR PRESSURE TUBES. PART II. MAY AND JUNE 1962. D. R. Doman and P. J. Pankaskie (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 1962. Contract AT(45-1)-1350. 25p.

A pressure tube surveillance program was undertaken in conjunction with Plutonium Recycle Test Reactor operation. It consists of in-reactor monitoring and pre- and post-irradiation testing and evaluation of the Zircaloy-2 pressure tubes. All 85 pressure tubes were visually examined and fretting mark depths measured. Gas gap and inside diameter measurements were made on 11 tubes, including initial measurements on four recently installed tubes. Approximately 1600 marks were found and measured. The maximum number of marks found in a single tube was 78. The maximum penetration, 26 mils, occurred in about two months of reactor operating time. The room-temperature burst strength of irradiated tube sections with fret marks up to 17 and 26 mils deep was higher than that of comparable unirradiated tube sections. No creep occurred in the pressure tubes. Satisfactory gas gaps were maintained. (M.C.G.)

10129 (JAERI-1028) RADIATION MONITORING OF JRR-2 DURING ITS CRITICAL EXPERIMENT AND POWER-UP TEST. S. Fukuda, J. Katoh, T. Ohnisi, et al. (Japan Atomic Energy Research Inst., Tokyo). 1962. 58p. (In Japanese)

Radiation monitoring during work related to critical experiments and related to JRR-2 experiments is described. The reported monitoring was carried out during fuel preparation, a critical experiment and characteristic test, power-up test, and during a reactor continuous operation test. (J.R.D.)

10130 (NP-12379) MOCK-UP REACTOR, NASA PLUM BROOK REACTOR FACILITY. Final Hazards Summary. W. A. Poley and P. M. Finnegan, eds. (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Sept. 1962. 132p.

A safeguards and hazards summary for the Plum Brook Mock-Up Reactor is presented. It is a low-power, highly enriched, water-cooled and moderated, beryllium-water reflected reactor. The fuel elements will come from the Plum Brook Research Reactor supply. The site and facility, reactor and components, radiation shielding and monitoring, reactor control and safety system, reactor physics, heat transfer, experimental program, handling of fuel and test containers, handling of radioactive wastes, organization and operation, and safeguards and hazards

considerations are discussed. General safety procedures are outlined. (M.C.G.)

10131 (RISÖ-43) MEASUREMENT OF THE EPITHERMAL NEUTRON FLUX IN THE REACTOR DR 1. B. Fastrup and J. Olsen (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Nov. 1962. 32p. (SM-36/21)

The thermal and the epithermal parts of the neutron spectrum in the Westcott flux notation are calculated from the activities of foils irradiated bare and Cd covered. Detectors of Au, Mn, Co, W, and In were irradiated in the center of the water-boiler, DR 1. In addition, a semi-differential method is presented from which the shape of the epithermal neutron spectrum can be determined from activation measurements. (auth)

10132 (WCAP-1556) PROOF TEST CRITICAL EXPERIMENTS FOR THE BR-3. H. W. Graves, Jr. and P. W. Davison (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). July 1960. 77p.

A series of critical experiments which were performed on the core of the BR-3 reactor before its shipment to the plant site in Mol, Belgium, is described. Both reactivity and flux distribution measurements were performed, and the results were compared with analytical results. In general, the agreement between experiment and theory is good and indicates that the core will meet specifications of power output (40.9 thermal Mw) and lifetime (7000 full power hours). (auth)

10133 MOATA REACTOR. A. P. Marks (Australian Atomic Energy Commission's Research Establishment, Lucas Heights, New South Wales). At. Energy, 5: No. 4, 9-22(Oct. 1962).

The Moata Reactor is a research reactor with a peak thermal neutron flux at 10 kw of 1.46×10^{11} neutrons/cm^2/sec. A description is given of its design and operation. (R.J.S.)

10134 PROBLEMS CONCERNING THE SAFETY OF RESEARCH REACTORS MODERATED AND COOLED WITH ORDINARY WATER. J. Lacour, J. Rastoin, E. de Robien, and F. de Vathaire. Bull. Inform. Sci. Tech. (Paris), No. 63, 25-30(July 1962). (In French)

The main problems regarding the safety in operation of research reactors moderated and cooled with ordinary water are listed. Particular consideration is given to the cases of high-power swimming-pool piles and of reactors for the irradiation of materials. Intrinsic and extrinsic safety factors, cooling and reactivity accidents, additional danger factors linked with the presence of irradiation loops, and the required qualifications for the reactor building are dealt with successively. Certain special studies carried out in France are briefly described. (auth)

10135 THE REACTOR "CABRI." J. Ailloud, M. Chatoux, F. de Vathaire, and J.-P. Millot. Bull. Inform. Sci. Tech. (Paris), No. 63, 96-112(July 1962). (In French)

The reactor Cabri, a pulsed swimming-pool pile designed for safety studies (accidental kinetics of a light-water reactor, instability phenomena, fuel tests, tests on the control and safety devices, etc.), is described. The reactor and its annexes are discussed, and the measurement and information analysis equipment is listed. (auth)

10136 REACTOR LOOPS AT CHALK RIVER. Ronald Needham (Atomic Energy of Canada Ltd., Chalk River). Can. Nucl. Technol., 1: No. 6, 40-2(1962).

Design characteristics of water-, steam-, and organic-cooled in-pile loops in the NRU and NRX reactors are described. Loop materials, temperatures, pressures, heat fluxes, and coolant flow rates are tabulated. Experimental procedures for the loops are described. (T.F.H.)

10137 THE ONE MEGAWATT POOL REACTOR FRM OF TECHNISCHE HOCHSCHULE MUENCHEN, GERMANY. H. Maier-Leibnitz (Technische Hochschule, Munich). Res. Reactor J., 3: No. 1, 1-8(Oct. 1962).

The concept, programs, operations, facilities, buildings, beam tubes, loops, irradiation facilities, reactor proper, and administration of the FRM swimming-pool research reactor are reviewed. (T.F.H.)

10138 DESIGN AND INSTALLATION OF A LOW TEMPERATURE IRRADIATION FACILITY AT THE MUNICH RESEARCH REACTOR FRM. N. Riehl, W. Schilling, and H. Meissner (Technische Hochschule, Munich). Res. Reactor J., 3: No. 1, 9-13(Oct. 1962).

A description is given of the design, operation, safety features, and uses of the low-temperature irradiation system. The irradiation and annealing cryostats and refrigerator are described. (T.F.H.)

10139 FLUX MEASUREMENTS AND ABSOLUTE CALIBRATIONS AT FRM. W. Koehler (Technische Hochschule, Munich). Res. Reactor J., 3: No. 1, 14-19(Oct. 1962).

Activation methods for determining the neutron spectral and spatial distributions in swimming-pool research reactors are outlined. The activation cross sections for several nuclides are tabulated in order to compare their usefulness in the flux activation methods. (T.F.H.)

10140 PROGRAMMING AND UTILIZATION OF RESEARCH REACTORS. VOLUME 2. Proceedings of a Symposium held in Vienna, October 16-21, 1961. London, Academic Press Inc., 1962. 541p. $15.00.

Forty-six papers are included, separate abstracts have been prepared for forty-two. Three papers have been previously abstracted in NSA. (D.C.W.)

10141 RESEARCH PROGRAM AT THE MIT NUCLEAR REACTOR. T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). p.3-20 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Design of the heavy-water cooled and moderated MIT Nuclear Reactor to provide optimum research facilities is discussed and diagrammatically displayed along with various operating characteristics. Neutron and gamma spectrometer experiments as well as medical therapy performed are also mentioned. (D.C.W.)

10142 USE OF A MODERATE-POWER NUCLEAR REACTOR IN AN ATOMIC ENERGY RESEARCH LABORATORY. W. H. McCorkle (Argonne National Lab., Ill.). p.21-36 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Growth of research, cost of operation, and fields of research are reviewed for the past 7½ years of operation of the CP-5 research reactor at Argonne National Laboratory. (137 references) (D.C.W.)

10143 THE ECO REACTOR. V. Raievski (Euratom, Joint Research Centre, Ispra, Italy). p.37-44 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Technical description is given for a reactor (ECO, Esperienza Critica Orgel) to investigate lattice parameters of organic-cooled, heavy-water moderated reactors as an aid in establishing a method of nuclear calculation for such reactors. The procedure to be followed with ECO is derived from buckling measurements on Aquilan, a natural uranium, heavy-water critical assembly. (D.C.W.)

10144 THE UTILIZATION OF THE HORIZONTAL FACILITIES ON HIFAR. T. M. Sabine and J. L. Symonds (Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales, Australia). p. 45-9 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

High flux horizontal facilities provided on the Australian DIDO-type reactor HIFAR are described along with proposed modifications. Low and medium flux facilities and their associated equipment are also described. (D.C.W.)

10145 UTILIZATION OF BR1. G. Stiennon (Centre d'Etude de l'Energie Nucléaire, Brussels). p.51-5 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In French)

Effective cross section measurements by time-of-flight methods; discovery of new isomeric states; disintegration schemes of various fission products; measurement of activation cross sections for neutron spectra; and various studies in solid state physics, pile physics, and use of fission products in chemical reactions are included in a review of work with the BR1 pile. (D.C.W.)

10146 THE OPERATION, PROGRAMMING AND USAGE OF BEPO, GLEEP, AND LIDO. J. F. Hill (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.57-69 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Descriptions of two graphite-moderated (BEPO and GLEEP) and one pool type (LIDO) reactors are given, and the operational and experimental programs of each are described. (D.C.W.)

10147 INFLUENCE OF OPERATING CONDITIONS ON THE CHARACTERISTICS OF THE SILOE REACTOR DESTINED FOR GHENT UNIVERSITY. Charles V. Dehon (Societé Belge pour l'Industrie Nucléaire, Brussels). p.71-89 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In French)

A pool type reactor (SILOE) to be used by the chemistry department at the State University of Belgium at Ghent is discussed, and its safety features pointed out. Diagrams of the reactor and its safety system are included. (D.C.W.)

10148 RESEARCH PROGRAMS WITH THE TRIGA REACTORS. Frederic de Hoffman (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.91-115 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Triga Mark 1 and Triga Mark F designs are described and their performance noted. Research programs utilizing these reactors encompass neutron activation analysis, biomedical studies, thermionic and thermoelectric energy conversion, solid state work, testing of reactor designs, and radiation pulse research. (D.C.W.)

10149 PROGRAMME AND UTILIZATION OF THE TRIGA REACTOR IN THE INSTITUTE FOR RADIOACTIVE RESEARCH OF THE ENGINEERING SCHOOL OF THE UNIVERSITY OF MINAS GERAIS. F. A. Gomes, J. I. Vargas, and M. Campos (Universidade de Minas Gerais, Brazil). p.117-26 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Educational, operational, and experimental aspects of the work with the IPR-R1 reactor (Triga) at Minas Gerais, Brazil are reviewed. (D.C.W.)

10150 REPORT ON THE DEVELOPMENT OF THE TRICO NUCLEAR CENTER. J. Kahamba and L. P. Gillon (Centre Nucléaire TRICO, Leopoldville, Congo). p.127-31 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In French)

Utilization of the Triga Mark 1 reactor at Leopoldville, Congo, for research as well as isotope production is discussed. Agricultural and biomedical experiments are part of an extensive program to be extended. Aims in forming the research center are also mentioned. (D.C.W.)

10151 SUGGESTIONS FOR IMPROVEMENTS CONCERNING THE EXPERIMENTAL FACILITIES IN SMALL REACTORS. L. Di Palo (Comitato Nazionale per l'Energia Nucleare, Rome), M. Marseguerra, F. Marsili, S. Sciuti, R. H. Peters, M. T. Simnad, and W. L. Wyman. p.133-41 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Alterations on the RC-1 Reactor (a TRIGA Mark II) include improvement of watertightness, provision of mobile safety shutters, and addition of a vertical tube through the thermal column. Safety and facilitation of research are improved. (D.C.W.)

10152 BATTELLE RESEARCH REACTOR — FIVE YEARS OF OPERATION. Joel W. Chastain, Jr. (Battelle Memorial Inst., Columbus, Ohio). p.153-71 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Cost, design, construction, operational procedure, experimental programs, and problems met are reviewed for the five-year-old open-pool reactor at Battelle Memorial Institute in Columbus, Ohio. (D.C.W.)

10153 THE MAIN LINE OF RESEARCH WITH THE REACTOR IRT-2000. E. L. Andronikashvili (Inst. of Physics, Tbilisi, USSR). p.173-92 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In Russian)

Radiation solid state physics, nuclear chemistry, and nuclear technique are studied using the reactor at the Physics Institute of the Georgian SSR Academy of Sciences. Radiation effects on single crystals of alkaline-halides are studied (pictures included), showing that microhardness of KCL crystals increases to saturation. Dislocations in alkaline haloids result from n,γ irradiation. The process of labeling ethane with recoil tritium from the $Li^6(n,\alpha)T^3$ reaction using silica-gel is treated. The construction of a circulating radiation loop to be used as a strong gamma source in conjunction with a nuclear reactor is shown. (D.C.W.)

10154 OPERATING CHARACTERISTICS AND UTILIZATION OF THE MELUSINE REACTOR. F. Rossillon (Centre d'Études Nucléaires, Grenoble, France). p.193-203 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In French)

Design of the MELUSINE at Grenoble, France is given; and its safety features and operational procedure are discussed. Experiments performed in two years of operation include solid state physics, radiochemistry, and magnetic resonance. (D.C.W.)

10155 PROGRESS REPORT ON A PROGRAMME FOR A LOW POWER RESEARCH REACTOR. A. J. Salmon (Associated Electrical Industries Ltd., Aldermaston, Berks, Eng.). p.205-13 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Limited to an output of 80 Mwh/week, the Merlin low-power reactor is supposed to benefit the electrical industry as a research tool. Experiments in physics, electrical en-

gineering, chemistry, metallurgy, and solid state physics are scheduled, and the program is to be expanded. (D.C.W.)

10156 SOME ASPECTS OF UTILIZING THE REACTOR JEN-1. J. Montes, L. Mañas, G. Dominguez, F. de la Cruz, and M. A. Vigon (Junta de Energía Nuclear, Madrid). p.215-22 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In Spanish)

Studies of Fermi states, neutron distribution, and neutron spectra are carried out using the pool-type reactor JEN-1, at Madrid, Spain. Isotopes are also produced and radiochemical experiments carried out. (D.C.W.)

10157 THE OPERATION AND UTILIZATION OF THE RESEARCH REACTOR HERALD. J. J. McEnhill and F. J. Barclay (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.243-57 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Need for designing for flexible utilization is borne out by the necessity of adding irradiation rigs to the HERALD. Allowance for vertical movement was originally thought advisable, but now is deemed a safety hazard. Other points of design are discussed, and the organizational and operational aspects are reviewed. Nuclear data measurements on absolute fission cross sections, ratio of capture to fission cross sections of isotopes, power output from fission products, neutron scattering from moderators, and radiochemical studies of fission product yields are being obtained. (D.C.W.)

10158 SOME IRRADIATION CAPABILITIES AVAILABLE IN THE EL2 AND EL3 REACTORS. J. P. Genthon and J. Lalere (Commissariat a l'Energie Atomique, Paris). p.267-81 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In French)

Radiation obtainable at the various sites in the heavy-water moderated reactors EL2 and EL3 is discussed and shown in tables. Limitations and advantages of each site are also presented. (D.C.W.)

10159 OPERATIONAL AND SAFEGUARDS EXPERIENCE WITH MERLIN. D. R. Chick, M. Kerridge, and A. J. Salmon (Associated Electrical Ind., Aldermaston, Berks, Eng.). p.283-94 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Safety design, early operation, operational experience, and proposed modifications are considered in a report on the MERLIN light-water moderated and cooled, open-tank reactor. (D.C.W.)

10160 OPERATION OF THE TRITON REACTOR FROM THE POINT OF VIEW OF SAFETY. J. Ailloud, R. Beauge, and J. Rastoin (Centre d'Études Nucléaires, Paris). p.295-304 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In French)

Organization of the personnel in charge of TRITON safety is related, and regulations for personnel and facilities involved in work therewith are explained. (D.C.W.)

10161 AN EMERGENCY SCHEME FOR THE 5 MEGAWATT RESEARCH REACTOR MERLIN. K. Boddy, D. R. Chick, S. E. Hunt, and A. J. Salmon (Associated Electrical Ind., Aldermaston, Berks, Eng.). p.305-11 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Procedure mapped out for dealing with possible safety hazards resulting from work with the MERLIN reactor is discussed, and the organization of personnel to deal with incidents is given. (D.C.W.)

10162 THE NUCLEAR RESEARCH CENTER OF THE GEORGIAN SSR. E. A. Andonikashvili (Inst. of Physics, Tbilisi, USSR). p.321-5 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In Russian)

The Nuclear Research Center of the Georgian SSR Academy of Sciences Institute of Physics is built round a 2000 kw(t) IRT-type reactor, which is equipped with an operational irradiation loop, a cobalt unit, and a radioisotope laboratory. Special premises for production of short-lived radioisotopes are at present under construction. The center is used for studies of nuclear physics, radiation chemistry, and radiobiology and in the food, textile, manganese, and metallurgical industries. (auth)

10163 HEALTH PHYSICS PROCEDURE WITH THE IEAR-1 BRAZILIAN RESEARCH REACTOR. D. M. Vizeu and W. S. C. Hehl (Instituto de Energia Atômica, São Paulo, Brazil). p.327-32 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Health physics procedure at the Brazilian research reactor, IEAR-1, utilizes two continuous air monitors, twice-daily surveys on external radiation levels, and burial of radioactive wastes. Results of air surveys and external radiation measurements are given. (D.C.W.)

10164 UTILIZATION OF THE PENNSYLVANIA STATE UNIVERSITY REACTOR FOR RESEARCH. Forrest J. Remick (Pennsylvania State Univ., University Park). p.333-50 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

General description of the Pennsylvania State University research reactor is accompanied by a program for use of the reactor, explaining cost of operation, current research, and proposed expansion of the facility. (D.C.W.)

10165 RESEARCH WITH SAPHIR. T. Huerlimann, P. Schmid, and H. Winkler (Federal Inst. for Reactor Research (EIR), Würenlingen, Switzerland). p.351-9 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Materials testing, activation analysis, macroscopic cross section measurements, isotope production, shielding measurements, gamma and neutron radiation experiments, training, and nuclear physics experiments are performed using the SAPHIR swimming pool reactor in Switzerland. (D.C.W.)

10166 THE THREE YEARS OF OPERATION OF THE FIRST NUCLEAR RESEARCH REACTOR EVA. E. Aleksandrovich and T. Bernes (Inst. for Nuclear Research, Polish Academy of Sciences, Warsaw). p.361-9 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In Russian)

Description of Poland's first nuclear reactor, a tank-type, is presented along with discussion on obtaining better utilization. The reactor is used for experiments in nuclear spectrography, nuclear reactions, solid state physics, neutron diffraction research, reactor physics, and radiation chemistry and radiochemistry in addition to producing isotopes. (D.C.W.)

10167 A REVIEW OF THE RESEARCH WITH CZECHOSLOVAKIAN NUCLEAR REACTOR. F. Musilek (Inst. for Nuclear Research, Czechoslovak Academy of Sciences, Prague). p.371-3 of "Programming and Utilization of Re-

search Reactors. Vol. 2." London, Academic Press Inc., 1962. (In Russian)

First, the setting up and organization of the reactor laboratory are dealt with. The relations between this laboratory and the other laboratories in the Institute, programing, and the organization of experimental work with the reactor are examined. Experimental work on the reactor and problems associated with the use of the research reactor are reviewed. Then, the work of two research groups, particularly the organizational aspects, is described. The first group is investigating the radiative capture of thermal neutrons, the second automatic reactor start-up. The possibility of improving the reactor equipment and the organization of experimental work are also considered. (auth)

10168 THE PUERTO RICO NUCLEAR CENTER RESEARCH REACTOR: CHARACTERISTICS AND PROGRAM PLANS. J. C. Bugher (Rio Piedras Univ., Puerto Rico). p.375-82 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Studies in reactor physics, neutron concentrations in the core, and effects of neutron bombardment, and biomedical experiments are carried out using the Puerto Rican L-77 pool-type reactor. Tables present characteristics of the reactor. (D.C.W.)

10169 EDUCATION AND TRAINING EXPERIENCE WITH THE PENNSYLVANIA STATE UNIVERSITY REACTOR. Forrest J. Remick, Edward S. Kenney, and Gordon E. Robinson (Pennsylvania State Univ., University Park). p.383-91 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Experiments performed using the Penn. State reactor for graduate level laboratory instruction are described, and the various programs and institutes open to qualified personnel are discussed. (D.C.W.)

10170 RESEARCH UTILIZATION OF THE U. S. NAVAL RESEARCH LABORATORY REACTOR. J. O. Elliot (U. S. Naval Research Lab., Washington, D. C.). p.393-6 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Experiments involving neutron diffraction, neutron physics, activated nuclei, split fuel elements, and irradiations are performed with the U. S. Naval Research Laboratory reactor that is briefly described. (D.C.W.)

10171 OPERATIONAL EXPERIENCE AND UTILIZATION OF THE BRAZILIAN 5 MW SWIMMING-POOL REACTOR. Azor C. Penteado and M. D. De Souza Santos (Instituto de Energia Atomica, São Paulo, Brazil). p.397-408 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Fission products in the reactor cooling water and maintenance of an upper hot water layer to reduce surface activity are two problems met in the Brazilian IEAR-1 reactor. Radioisotope production, neutron beam experiments, training, and activation analysis are included in the reactor's program. (D.C.W.)

10172 ASTRA-REACTOR ENGINEERING EXPERIENCE AND EXPERIMENTAL WORK DURING THE FIRST YEAR OF OPERATION. H. Bildstein and A. Burtscher (Osterreichische Studiengesellschaft für Atomenergie, Reaktorzentrum Siebersdorf, Austria). p.409-17 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Problems encountered with the ASTRA reactor include shortage of welders to handle the aluminum tank and breakage of heat exchanger tubes due to water turbulence. Critical experiments, flux measurements, reactivity measurements, and void and temperature coefficient measurements made on the reactor are reported. A summation of reactor utilization is provided. (D.C.W.)

10173 USE OF THE 10 kW ARGONAUT-TYPE RESEARCH REACTOR AT PETTEN, THE NETHERLANDS. J. A. Goedkoop and J. Pelser (Reactor Centrum Nederland, Petten, Netherlands). p.431-6 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

The low flux reactor at the Netherlands Reactor Centre is used while the high flux reactor is being completed. The reactor, as described, serves as a tool for low power reactor physics measurements and as a neutron source. Descriptions of the reactor and experimental facilities are detailed. (D.C.W.)

10174 THE SIEMENS REACTOR STATION AT MUNICH. W. Humbach (Siemens-Schuckertwerke AG, Munich). p.437-46 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Measurements with lattice subsections, measurements of reactivity coefficients of void and temperature, and shielding measurements performed with the Siemens Argonaut Reactor are reported. Description of the reactor is aided by diagrams, and graphs display experimental data. (D.C.W.)

10175 SELECTION OF A SUITABLE REACTOR FOR RESEARCH IN REACTOR PHYSICS AND UTILIZATION OF THE REACTOR FOR THE DETERMINATION OF NUCLEAR DESIGN PARAMETERS OF POWER REACTORS. G. Riesch (AEG-Kernenergieversuchsanlage, Grosswelzheim, Ger.). p.447-51 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

An Argonaut-type reactor is found most suitable for making measurements on power reactor lattices. Layouts of the facility and equipment required and the program of experiments are discussed. (D.C.W.)

10176 TRAINING REACTOR ULYSSE CONCEPTION AND PROGRAM OF UTILIZATION. Bernard Sautiez (Commissariat à l'Energie Atomique, Paris). p.453-69 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In French)

Details of the choice, design, construction, characteristics, and safety of the French Ulysse, an Argonaut-type reactor, are presented along with a brief outline of the program of utilization. (D.C.W.)

10177 EXPERIMENTAL REACTORS IN ARGENTINA: THEIR OPERATION AND UTILIZATION. Jorge Cosentino (Comisión Nacional de Energía Atómica, Buenos Aires). p.473-8 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In Spanish)

Details of the Argentine RA-1, RA-0, and RAEP reactors are given, and a brief summation of work to be done with them is presented. (D.C.W.)

10178 PROGRAMME OF EXPERIMENTS ON THE ZERO POWER REACTOR RB. N. M. Raišić (Boris Kidric Inst. of Nuclear Sciences, Belgrade). p.479-82 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

The Yugoslavian Zero Power Reactor lends itself to

criticality investigations into D_2O moderated lattices as well as measurements of other reactor parameters. Buckling determinations, partial loading measurements, temperature coefficient studies, reactor kinetics parameters determinations, and dosimetry measurements are scheduled for the present. (D.C.W.)

10179 REVIEW OF THE UTILIZATION OF JRR-1. A. Sugimoto and K. Kakihara (Japan Atomic Energy Research Inst., Tokyo). p.483-95 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

An operation schedule and a program of research encompassing reactor physics, neutron physics, and neutron irradiation are given for Japan's light-water moderated reactor JRR-1. Experiments (number and subject) are listed. (D.C.W.)

10180 A U.S. INDUSTRIAL REACTOR PROGRAM AND A NATIONAL PROGRAM IN A SMALL COUNTRY — SOME USEFUL ANALOGIES AND CONTRASTS. L. Reiffel (Armour Research Foundation, Chicago). p.497-501 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

For various reasons many small countries have curtailed their plans for nuclear centers. Unexpectedly continued high costs are just one reason. Others are dealt with in analogy to problems met by the Armour Research Foundation in its participator program. Measures to help the small nations are suggested. (D.C.W.)

10181 THE MAIN LINE OF RESEARCH WITH A NUMBER OF RESEARCH REACTORS IN USSR. M. I. Pevzner and A. M. Demidov (Kurchatov Inst. of Nuclear Energy, Academy of Sciences, USSR). p.503-12 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In Russian)

The main lines of research in physics at present being pursued with a number of research reactors of up to 5 Mw(t), operating in the Soviet Union are examined. The most promising type of reactor for the production of high neutron fluxes in the core and the beams extracted from it, and one which combines simplicity of design with economy and convenience in operation, is the water-moderated-and-cooled variety (IRT and WWR). Two reactors operated by the U.S.S.R. Academy of Sciences Institute of Nuclear Energy are being used for various nuclear projects (study of capture gamma rays, fission physics), and solid-state physics (cold neutron scattering, neutron diffraction studies), for investigating neutron thermalization and also for research on radiobiology. Other reactors of similar types being built and operated in the Union Republics are intended for pure and applied research, as required by the particular Republics concerned. A review of the main trends of this research is given. (auth)

10182 LOW-COST RESEARCH PROGRAMS FOR RESEARCH REACTORS. R. G. Cochran (Texas A. and M. Coll., College Station), J. W. Chastain, and T. J. Thompson. p.513-20 of "Programming and Utilization of Research Reactors. Vol. 2." London, Academic Press Inc., 1962. (In English)

Programs for research reactors generally involve great expense. Many experimental areas can be usefully explored with apparatus costing $5000 or less. Pile oscillators, shielding test apparatus, radiation damage equipment, and apparatus for some chemical and biological tests can be assembled within this limit. (D.C.W.)

10183 A NUCLEAR RESEARCH REACTOR. (to Licentia Patent-Verwaltungs GmbH). British Patent 913,168. Dec. 19, 1962. Priority date May 12, 1958, Germany.

A research reactor is designed for measuring the materials constants of materials to be used in nuclear reactors. The reactor comprises a fission zone surrounding a moderator zone which has electric heating means for varying the temperature and a central cavity for receiving the material to be tested. (D.L.C.)

SPACE APPLICATIONS AND TECHNOLOGY

10184 (AD-275297) PROCEEDINGS OF THE BUREAU OF NAVAL WEAPONS MISSILES AND ROCKETS SYMPOSIUM, CONCORD, CALIFORNIA, APRIL 18-21, 1961. (Naval Ammunition Depot, Concord, Calif.). 35p.

A total of 36 technical presentations are included in the proceedings. One paper was previously abstracted in NSA. Separate abstracts were prepared for 11 papers. The papers for which no abstracts were prepared were concerned with weapons quality evaluation, nondestructive testing, automatic electronic systems, rocket motors, propellants, and missiles. (J.R.D.)

10185 (AD-275297(p.15-17)) NUCLEAR POWER POTENTIAL FOR SPACE VEHICLES. Edward Teller (California. Univ., Berkeley. Lawrence Radiation Lab.).

A discussion is presented concerning how nuclear energy can be used to achieve space goals. Difficulties associated with rocket reactor operation such as radiation and weight are noted, and developments in the areas of ion propulsion and magnetic bottles for plasma jets are discussed. Speculation concerning a space ship with electromagnetic sails is offered. (J.R.D.)

10186 (AD-27297(p.29-34)) TECHNIQUES OF NONDESTRUCTIVE TESTING UTILIZING RADIOISOTOPES. C. A. Stone (Illinois Inst. of Tech., Chicago. Armour Research Foundation).

Developments in radioisotopic nondestructive testing are discussed. Developmental programs in the areas of secondary x-ray sources, improved nuclear density gages, neutron techniques, and applications of the Mössbauer effect are examined. It is noted that many untried areas remain where these techniques can probably be used. (J.R.D.)

10187 (AD-275297(p.51-65)) NEW DEVELOPMENTS IN NONDESTRUCTIVE TESTING AT ARGONNE NATIONAL LABORATORY. Warren J. McGonnagle (Argonne National Lab., Ill.).

A discussion of the nondestructive evaluation of materials by ultrasonics, radiography, and eddy-current techniques is presented. Details by neutron radiography are given, and a double-pulse system for eddy-current testing is described. Eddy-current nondestructive testing for EBR-II fuel elements is also discussed. (J.R.D.)

10188 (AD-275297(p.70-4)) INTERNAL INSPECTION OF LARGE PROPULSION UNITS BY ION CHAMBERS AND SCINTILLATOR DETECTORS. J. I. Bujes (Naval Ordnance Test Station, Inyokern (China Lake), Calif.).

Aspects of internal inspection of solid propellants are discussed. Reductions in radiographic inspection time and costs by the use of scanning detectors are described. Included are discussions concerning the design and performance of ion chambers and scintillators and inspection of Polaris and Minuteman propellants. (J.R.D.)

10189 (AD-275297(p.112-15)) FAST NEUTRON RADIOGRAPHY. E. L. Criscuolo and Daniel Polansky (Naval Ordnance Lab., White Oak, Md.).

Preliminary information is presented concerning the applicability of neutron radiography in the inspection of large masses of material. Data are included which were obtained using 14-Mev neutrons in exposures of Pb, Cu, steel, Al, paraffin, and masonite. Resolution of a rubber O-ring through 2 in. of Pb was achieved. (J.R.D.)

10190 (AD-275297(p.116-20)) FLUOROSCOPIC TECHNIQUES OF FUZE EVALUATION. Otto Renius and Webster Taylor (Lake City Arsenal, Independence, Mo.).

Results of a feasibility study on the applicability of fluoroscopic methods in the evaluation of 20-mm fuze assemblies are presented. Design of equipment used in the evaluation is described, and test results are discussed. It is noted that in a system for fluoroscopic evaluation of these fuzes, a proper balance must be maintained between sensitivity, usefulness, and safety. (J.R.D.)

10191 (AD-275297(p.131-49)) 10-Mev ROTATING TARGET LINEAR ACCELERATOR FOR RADIOGRAPHY OF LARGE ROCKET MOTORS. John H. Cusick(Naval Ammunition Depot, Concord, Calif.) and J. A. Haimson (Varian Associates, Palo Alto, Calif.).

Activities in a program to develop a 10-Mev electron linac for radiographic uses are reported. Details of the design of this facility are also included along with preliminary data on performance. Present and future applications of this installation to nondestructive examination of large missile and rocket motors are discussed. (J.R.D.)

10192 (AD-275297(p.173-91)) RADIOLOGICAL PHYSICS ASPECTS OF HIGH ENERGY X-RAY INSPECTION SYSTEMS. David L. Dye (Boeing Co. Aero-Space Div., Seattle).

A discussion concerning the radiological physics aspects of design of components for high-energy x-ray inspection systems is presented. Special attention is directed to problems arising because of the high-energy photon spectra which are involved. The parameters of interest in either scanning as radiographic systems are not normally the quantities which can be directly measured. A means of relating observable quantities (ionization measurements) to parameters of interest is discussed. (J.R.D.)

10193 (AD-275297(p.278-85)) RESEARCH AND DEVELOPMENT APPLICATIONS OF PARTICLE ACCELERATORS FOR MISSILE AND SPACE PROGRAMS. E. Alfred Burrill (High Voltage Engineering Corp., Burlington, Mass.).

A discussion is presented concerning the general characteristics of accelerators and their nuclear particles and radiations. Descriptions of techniques and experiments with accelerators in the areas of analysis, evaluation, and testing of materials are included. The usefulness of accelerators in research and development of missiles and space programs is also discussed. (J.R.D.)

10194 (AD-275297(p.302-4)) A MULTIPLE PULSE X-RAY SYSTEM AS A NEW TECHNIQUE IN ENVIRONMENTAL TESTING. L. C. Foster and John K. Landre (Zenith Radio Research Corp., Menlo Park, Calif.).

A multiple-pulse x-ray system is described which has applications in inspection of components which cannot be opened or made visible without affecting their dynamic properties. The system makes possible the production of x-ray motion pictures of high-speed phenomena. The development opens new possibilities in cases where movement needs investigating. (J.R.D.)

10195 JPL-TR-32-201) VORTEX-TUBE AND REGENERATIVE-COOLING-TUBE PARAMETERS FOR GASEOUS FISSION REACTORS. Henry J. Stumpf (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). Jan. 22, 1962. Contract NASw-6. 12p.

The performance of the vortex-tube reactor is governed primarily by the propellant mass flow rate, radius, and

number of vortex tubes. A simple analysis is carried out to define roughly the range of variables for which system performance is attractive. It is shown that the ratio of the radiation terms ϵ_c/β establishes the allowable range of values for the vortex-tube parameters. Whether or not the required values of ϵ_c/β can be obtained while maintaining adequate system capabilities depends upon the solution of the thermal radiation problem. The regenerative-cooling-tube parameters depend primarily upon the cooling-tube void fraction. (auth)

10196 (N62-12872) AN EVALUATION OF A CESIUM ION ROCKET EMPLOYING A LARGE POROUS TUNGSTEN IONIZER. Ronald J. Cybulski and Thomas J. Kotnik (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). 1962. 11p.

An ion rocket engine was operated for more than 50 hours using a porous tungsten ionizer. The ionizer was assembled using the techniques of electron beam welding, combined with a high temperature furnace braze. Accelerator and power efficiencies of 90 to 70 percent, respectively, were obtained at a current density of 113 amperes per square meter. This power efficiency was obtained at a specific impulse of 8680 seconds. Preliminary results indicate a propellant utilization efficiency of about 90 percent. (auth)

10197 (NASA-TN-D-1563) FEASIBILITY OF APPLYING FIELD-ION EMISSION TO ELECTROSTATIC ROCKET ENGINES. N. Stankiewicz (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Jan. 1963. 21p.

The Wentzel, Kramers, Brillouin method was used to determine the ionization lifetimes of hydrogen, lithium, sodium, rubidium, cesium, and xenon in an applied electric field. These lifetimes were used in the analysis of a theoretical plane-diode engine consisting of a grid emitter that field-ionizes the impinging propellant. Results show that monatomic gaseous propellants are not suitable for field-ion emission engines of this design because of the excessively high voltage requirements for ionization. (auth)

10198 (NASA-TR-R-140) PERIGEE PROPULSION FOR ORBITAL LAUNCH OF NUCLEAR ROCKETS. Paul G. Johnson and Frank E. Rom (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). 1962. 24p.

A thrust program called perigee propulsion which minimizes gravity loss was analyzed. Thrust is applied intermittently in regions of high velocity (near successive perigees). The increased energy-addition efficiency yields mass ratios approaching those for impulsive velocity change. Corresponding times to reach desired energy are in days but are still small relative to mission times. For specified orbital-launch missions, perigee-propulsion nuclear rocket systems are shown to equal continuous-thrust performance with reactor powers an order of magnitude less than those of continuous-thrust systems. Application and operational aspects of perigee propulsion are discussed. (auth)

10199 (NP-12323) SPACE ELECTRIC POWER SYSTEMS STUDY. Fourth Quarterly Progress Report, August 8, 1962, to November 8, 1962. F. X. Dobler, C. L. Doughman, J. B. Fanger, et al. (Westinghouse Electric Corp. Aerospace Electrical Div., Lima, Ohio). Contract NAS 5-1234. 239p.

Activities in a program to develop parametric data concerning the generation, control, conversion, and transmission of electric power for space vehicles are reported. The generator coolant temperature is to be 500 to 1500°F; the ratings to be studied are 250 kw to 10 Mw at voltages up to 50,000 d-c. Information is included on conceptual system designs for three power systems; one for production of 600 to 6000 volts d-c in 8 steps, another for production of 4000 volts d-c constant, and a third for production of 20,000 volts d-c constant. Parametric data are also included concerning 250 to 500 kw electric power systems. (J.R.D.)

10200 (NP-12371) THE PROSPECTS FOR ACTIVE SHIELDING. R. H. Levy (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Nov. 1962. Contract Nonr-2524(00). 14p. (AMP-94)

A review is given of the reasons for the interest in active shielding and the types of missions for which an active shield would be particularly desirable are discussed. Recent work on active shielding is reviewed. Electrostatic shielding is discussed. In general, the maintenance of an electrostatic field for shielding purposes will require the expenditure of power owing to the presence of a neutral highly conducting plasma. Estimates of the power required are extremely high, and electrostatic shielding appears unattractive. Magnetic shielding is also discussed. The virial theorem on the weights of magnetic field coils in space is explained, and it is shown how this theorem can be used to make a direct comparison between the use of a material as an element in a structure and as a stopping material for energetic protons. The result of this comparison is that for sufficiently large sizes magnetic shielding will always be superior, but that the sizes involved are extremely large. The way in which the critical size scales with the strength to weight ratio for structural materials and the magnetic field strength is discussed. The status and prospects for large superconducting radiation shields are reviewed with particular emphasis on those features which are likely to make the minimum weights estimated by the virial theorem unduly optimistic. In conclusion, the possibility of shielding a space craft by blowing a hole in the interplanetary magnetic field (along which the protons move) with an atomic bomb is mentioned. It appears that such a shield would violate Liouville's theorem. (auth)

10201 NUCLEAR ENERGY AND RADIATIVE HEAT TRANSFER. W. Peschka. Astronaut. Acta, 8: 278-303 (1962). (In German)

It is shown that a U plasma reactor operating at high temperatures (e.g., 30,000°K) can yield an amount of energy, as a result of optical radiation impinging upon an expellant mass, sufficient to produce a thrust of some hundreds of tons per square meter of radiating area. If water is used as the expellant mass, exhaust velocities on the order of 2×10^4 m/sec are attainable. The confinement of the plasma reactor can only be accomplished by an electromagnetic field. The electrical energy required for this purpose may be taken directly from the thrust jet via a magneto-fluid-dynamic transformer. (auth)

10202 NUCLEAR PROPULSION. Frank E. Rom (NASA Lewis Research Center, Cleveland) and Harold B. Finger. Astronautics, 7: No. 11, 90-1(Nov. 1962).

A brief discussion of the past year's work on nuclear-rocket engines is presented to show the present state of development and to outline objectives for the near future. (D.C.W.)

10203 POWER SYSTEMS. Nathan W. Snyder (Kaiser Aircraft and Electronics, Oakland, Calif.). Astronautics, 7: No. 11, 110-14(Nov. 1962).

Low power output of other devices at this time dictates the use of nuclear-reactor systems for manned space explorations. Work up to the present is briefly reviewed, and progress and utilization of other power supplies are discussed. Pros and cons of solar cells, fuel cells, and thermoelectric and thermionic devices are included as well as consideration of energy storage, solar energy collector technology, and heat transfer and rejection for space power. (D.C.W.)

10204 RAMJETS. Gordon L. Dugger (Johns Hopkins Univ., Silver Spring, Md.). Astronautics, 7: No. 11, 138-42(Nov. 1962).

Nuclear turbojets have been supplanted in research programs by nuclear ramjets due to the simplicity of the latter. Tests with the Tory II reactor are mentioned in a report on various ramjet design parameters. (D.C.W.)

10205 NUCLEAR-ROCKET APPLICATIONS. Paul G. Johnson (NASA Office of Plans and Program Evaluation, Washington, D. C.). Astronautics, 7: No. 12, 22-7(Dec. 1962).

Studies have been made of the feasibility of using nuclear rockets in the deep-space applications of lunar ferrying, interplanetary round trips, solar system probing, rescues, and satellite maneuvers. (R.J.S.)

10206 RIFT. W. Scott Fellows (NASA Marshall Space Flight Center, Huntsville, Ala.). Astronautics, 7: No. 12, 38-47(Dec. 1962).

The Rift project consists of the design of the nuclear stage, the associated research and development necessary to qualify materials and components which will adequately withstand the added environment of nuclear radiation, the fabrication and assembly of the stages for static testing and launching, integration of the Nerva engine and other systems into a complete stage and the stage into a complete vehicle, and, finally, static testing and flight demonstration. Design and development of the Rift vehicle, along with associated component development, follows a logical plan, in which conceptual engineering design, planning of the over-all development and test program, and thorough investigation of critical problem areas will be done before commitment of major hardware items to fabrication. Although there are many technical areas in which state-of-the-art work must be extended, there are no identifiable vehicle problems that require a breakthrough in the state of the art. The Rift project can therefore be pursued in an orderly fashion based on availability of Kiwi/Nerva powerplants. It is reasonable to expect that early application of nuclear propulsion to space exploration can be achieved. (R.J.S.)

10207 NUCLEAR-ENGINE DESIGN GOALS. Charles H. Trent (Aerojet-General Corp., Azusa, Calif.). Astronautics, 7: No. 12, 54-7(Dec. 1962).

Progress is being made toward a nuclear-propulsion device that has an operational flexibility and performance markedly transcending the capabilities of the highest performance liquid- and solid-propellant rocket engines. Specific design and development goals for succeeding nuclear-rocket engines include the following: increased performance through higher reactor operating temperatures with reactor designs to accommodate the topping cycle desirable; increase in engine specific thrust through decrease in reactor weight; a simplified engine-control system with a propellant-feed system that can pump boiling hydrogen; and a system of self-destruction for the reactor in the event of abnormal operation. (R.J.S.)

10208 KIWI DEVELOPMENTAL TESTING. Keith Boyer (Los Alamos Scientific Lab., N. Mex.). Astronautics, 7: No. 12, 58-62(Dec. 1962).

Four reactors have been operated on gaseous hydrogen at significantly higher power densities than attained before in reactor design. A series of cold-flow tests using a mockup reactor have been used to determine the first part of an acceptable startup profile for reactor operations with liquid hydrogen. Control systems applicable to a nuclear-propulsion engine have been developed which handle transients experienced during liquid-hydrogen startup and can be programmed to demand and maintain the desired temperature and mass-flow-rate profiles. A satisfactory nozzle has been developed which uses liquid-hydrogen regenerative cooling. (R.J.S.)

10209 SAFETY AND OPERATIONS WITH NUCLEAR VEHICLES. Ralph S. Decker (NASA-AEC Space Nuclear Propulsion Office, Washington, D. C.). Astronautics, 7: No. 12, 63-5(Dec. 1962).

Since the reactor is not radioactive until after operation, there is no hazard associated with reactor assembly, checkout, and handling unless an accident occurs. With careful planning and the use of straightforward countermeasures, the probability of an excursion can be made exceedingly small. Other simple measures such as enforced exclusion areas can be employed, so that even if all countermeasures failed an excursion would not result in undue risk to health and safety. In many operational situations where planned or accidental thrust termination leaves the nuclear stage at less than escape velocity, a positive countermeasure must be employed to preclude premature, random re-entry and impact. Several means of reactor destruct appear feasible; when coupled with unavoidable re-entry effects, these would assure safe disposal of fission products in the upper atmosphere. Controlled re-entry represents an alternate solution. The development of lightweight, effective, reliable countermeasures to assure safe reactor disposal is the most difficult safety problem associated with nuclear rockets. The use of nuclear propulsion does not introduce significant new risks for astronauts. The extra payload potential of nuclear rockets can in fact be used to enhance crew safety. (R.J.S.)

10210 A SPACESHIP WITH NUCLEAR PROPULSION. Jindrich Pokorny. Kridla Vlasti, No. 13, 372-3(1962).

A proposed space vehicle with nuclear propulsion for a round-trip Martian mission is described. It would be powered by a 270-Mw graphite-moderated, U-fueled nuclear reactor with a core 1 m high by 1 m in diameter, and use gas as propellant. The gas would be heated to the maximum temperature in the reactor and additionally accelerated by an electromagnetic field. To this end, small quantities of K would be injected into the gas stream to increase its electric conductivity. The required electrical energy would be produced by liquid-Na-cooled thermionic converters. The vehicle would weigh 115000 kg, including 43000 kg of H propellant with tankage, and 7000 kg of sustenance material for one year. Chemical rockets would launch the vehicle with a crew of three men into an earth orbit where nuclear propulsion would take over. Upon reactor start-up, three heat exchangers (minimum dimensions 30 × 18 m) would be fanned out. A shielded well with a diameter of 2.5 m would protect the crew from radiation during reactor operation, passage through the earth radiation belts, and at periods of solar flares. (OTS)

10211 POWER REQUIREMENTS FOR DIRECT-BROADCAST SATELLITES. Harold L. Davis. Nucleonics, 21: No. 1, 53-6(Jan. 1963).

Recent calculations indicate that the power needed for satellite-to-home TV receiver broadcasting is less than formerly calculated, and could easily be supplied by the

SNAP-8 power supply. Such a system would cost less than present systems. (D.C.W.)

10212 SPACE PROBE LIMITATIONS ON NUCLEAR-ELECTRIC POWER SUPPLIES. Owen W. Welles (Space-General Corp., El Monte, Calif.). ARS Preprint No. 2527-62. New York, American Rocket Society, 1962. Prepublication Copy. 8p. $1.00.

The various relations between a deep space probe and its nuclear-electric power supply are reviewed, in order to predict the constraints of the probe on the supply. The relations include the magnitude and type of power consumed by the probe, the relative weights of probe and power supply, and the mission duration. The environment created by the power supply constitutes another class of relations. Physical relations are associated primarily with the large radiators required for the power supply. It is shown that certain of the constraints considerably influence the power-supply design features. These constraints include control of scatter radiation, cancellation of rotating inertias, design for failure life much longer than wear-out, and provision for folding the radiators is most probes. (auth)

10213 THE NASA NUCLEAR ELECTRIC POWER PROGRAM. Fred Schulman (National Aeronautics and Space Administration, Washington, D. C.). ARS Preprint No. 2522-62. New York, American Rocket Society, 1962. Prepublication Copy. 11p. $1.00.

The projected requirements and capabilities for space electric power in the ranges below 0.5 kw, on the order of 10 kw, and on the order of 10 Mw are discussed. The uses of radioisotope, reactor, and advanced systems to fulfill the requirements are outlined. (T.F.H.)

10214 NUCLEAR ENERGY: THE SPACE EXPLORATION ENERGY SOURCE. Harold B. Finger (National Aeronautics and Space Administration, Washington, D. C.). p.71-81 of "Proceedings of the Second National Conference on the Peaceful Uses of Space, Seattle, Washington, May 8-10, 1962." NASA SP-8. Washington, D. C., National Aeronautics and Space Administration, 1962.

A review is given of progress in nuclear propulsion systems and nuclear-powered mission planning. Attention is given to both nuclear rockets and nuclear-electric systems. (T.F.H.)

10215 COUPLING NUCLEAR-THERMIONIC POWER TO ELECTRIC SPACECRAFT PROPULSION. J. F. McCartney (The Martin Co., Baltimore). ARS Preprint No. 2551-62. New York, American Rocket Society, 1962. Prepublication Copy. 10p. $1.00.

Input requirements for electric spacecraft propulsion devices are reviewed, and basic conceptual designs for coupling nuclear thermionic power to the devices and other spacecraft loads are presented. The arc-jet engine requires power with a characteristic of high current at relatively low voltage, which requirement suggests the direct connection of the device to the thermionic system output. MHD propulsion devices, utilizing both the crossed-field and arc-discharge principles, may be supplied from a thermionic power source without the use of power conversion equipment. The ion-propelled spacecraft requires nearly 85% of the thermionic electrical output converted to high-voltage d-c for supplying the ionizer and accelerating potentials. It is expected that power conversion equipment can be developed to provide outputs for ion propulsion in the megawatt range with an efficiency of 95% and a weight equal to or less than 2 lb/kw, including the thermal radiator. (auth)

10216 SPACE NUCLEAR POWER APPLICATIONS. HEARINGS BEFORE THE SUBCOMMITTEE ON RESEARCH, DEVELOPMENT, AND RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SEVENTH CONGRESS, SECOND SESSION, SEPTEMBER 13, 14, AND 19, 1962. (United States. Congress. Joint Committee on Atomic Energy). 376p. $1.00(GPO).

Hearings were held before the Subcommittee on Research, Development, and Radiation of the Joint Committee on Atomic Energy of the Congress of the United States on space nuclear power applications. Topics discussed included general aspects of the development and use of nuclear energy for space propulsion and power, program plans for carrying out unified development efforts on the various space projects, the Rover nuclear rocket development program, and the SNAP program for the development of compact long-lived electrical power generators for use in space missions, and the Pluto project aimed at the development of a nuclear ramjet engine for powering multimach numbered atmospheric missiles. Test results and development plans were also discussed. (C.H.)

10217 METHODS AND APPARATUS FOR DEVELOPING FORCES WITH ION BEAMS. George C. Baldwin (to General Electric Co.). U. S. Patent 3,050,652. Aug. 21, 1962.

Apparatus and methods are described employing a beam of high-speed ions to develop a force for propulsion purposes in which the total electrical charge of the beam at its exit point is substantially zero. (R.J.S.)

WASTE DISPOSAL AND PROCESSING

Refer also to abstract 8268.

10218 (IDO-14595) AN ECONOMIC EVALUATION OF ULTIMATE DISPOSAL OF LIQUID RADIOACTIVE WASTES BY THE FLUIDIZED BED CALCINATION PROCESS. J. I. Stevens (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Oct. 30, 1962. Contract AT(10-1)-205. 40p.

The costs of fluidized bed calcining of the acidic and re-acidified forms of Purex and Thorex wastes were determined. The wastes were assumed produced by a chemical processing plant recovering unburned fuel from 1500 tons/yr of U converter fuel at a burnup of 10,000 Mwd/ton and 270 tons/yr of Th converter fuel at 20,000 Mwd/ton. Also, investment costs for storage of the calcine in vented, air cooled, annular bins installed in underground concrete valuts were determined. The cost of fluidized bed calcining was determined at processing rates of 45, 60, and 75 gph for solids storage in bins varying from 3 to 22 in. thick and installed in underground concrete vaults containing 4, 12, 20, and 40 nested annular bins, each nest with an overall diameter of up to 12.5 ft. Aging had negligible effect on costs, except as it permitted thicker bins to be used. The lowest cost, 0.47×10^{-2} mills/kwh$_e$, was for processing acidic Purex and Thorex wastes at 75 gph with storage in an underground concrete vault containing 40 of the 12.5-ft-dia. nested bin arrays. And the highest cost, 2.9×10^{-2} mills/kwh$_e$, was for processing reacidified Purex and Thorex wastes at 45 gph with storage in an underground concrete vault containing 4 nested bin arrays. (auth)

10219 (ORNL-TM-343) UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT, JULY 1962. M. E. Whatley, P. A. Haas, R. W. Horton, A. D. Ryon, J. C. Suddath, and C. D. Watson (Oak Ridge National Lab., Tenn.). Jan. 7, 1963. Contract [W-7405-eng-26]. 39p.

Data and results from foam separation studies and waste processing studies are presented. The application of the Chi-Square statistical test to bubble size measurements for determining foam surface showed diameters to be normally distributed when spinnerette gas spargers are used but not when porous metal or fritted glass gas spargers are used. The mercury trap showed fairly good performance during run R-66 in the Waste Processing facility; however, mercury was deposited in various places throughout the system. The emergency off-gas line from the calciner was kept clean by a steam surge. (auth)

10220 (EURAEC-367) RESEARCH ON WATER TREATMENT AND RADIOACTIVE WASTE. Quarterly Report No. 9, April 1–June 30, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucleaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 048-61-4-RDB. 33p. A translation.

Elution tests on insolubilization of radioactive concentrates have been continued. The pilot installation has been tested using slurries with a humidity of from 60 to 98%. An elution test of a block of bitumen-slurry mixture has been started. Pumping tests have been carried out in wells to determine the coefficient of permeability. During the studies of the non-saturated zone it has been possible to show that the passage of water in a section gives rise to the formation of a thin saturated layer which moves toward the phreatic sheet. A new apparatus for sampling the water of the sheet has been constructed. Preliminary tests on the use of chemical barriers have been carried out in the laboratory. These tests have shown the possibility of blocking radioactive ions by the application of a solution of Na_3PO_4. The study of a system with three macroscopic compounds has entered its second phase by the study of the fixation properties of montmorillonite and glauconite saturated by two macroscopic ions. The ratio between the coefficient of static distribution and the migration speed of radioactive isotopes in the ground has been resolved by modifying the experimental technique which consists of following the penetration in a column of a thin radioactive zone. Iodine-131 fixation tests on active carbon in a continuous system have been resumed in a CO_2 environment. The results confirm those obtained in an atmospheric environment. The construction of the incinerator has been entirely completed. (R.J.S.)

10221 (EURAEC-443) RESEARCH INTO WATER AND RADIOACTIVE RESIDUE TREATMENT. Quarterly Report No. 10, July 1 to September 30, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 048-61-4-RDB. 32p. A translation.

Mud, ash, and evaporator concentrate elution tests with bitumen have been pursued. The pilot plant worked as expected and practical conclusions can already be drawn concerning subsequent industrial operation. A precise balance was determined between the activities found in the gases and the condensation water. The condensation water contains 5×10^{-4}% of the radioactivity introduced into the apparatus and the gases less than 1×10^{-4}%. Experiments with the new apparatus permitting the saturation degree variation in sand have shown that this method of work is of great value for the quantitative studies of reactions in an unsaturated medium. Hydrological measurements of the underground water have been pursued as well as some studies concerning the atmospheric pressure influence upon the water-level fluctuation. Radioisotope injection tests have actively been prepared by adapting the apparatus to tests at a depth of 5 m. A first test with I^{131} has been successful. Physicochemical studies of multi-component equilibriums have been pursued upon glauconite and montorillonite. Finally, distribution coefficient measurement series of Cs, Sr, and Eu for natural clays was ended by the pH influence study. The incineration worked for radioactive waste. Because of the presence of quantities of rubber and PVC, the filters were obstructed almost instantly. For this reason, the filters were taken out and the incinerator was operated with waste of such an activity that the maximum quantity of active material intended for the chimney could not be exceeded. Furthermore, a coke layer was placed into one of the combustion chambers, which strongly increases the temperature and considerably reduces the quantity of carried ashes. (auth)

10222 DECONTAMINATION AND SOLID WASTE HANDLING AT A.E.R.E., HARWELL. J. K. January. Birmingham Univ. Chem. Engr., 13: 105-7(1962).

The types of solid wastes are outlined and methods of handling are briefly described. Wastes are dumped at sea or buried. Methods of decontamination of equipment include the use of a jet of abrasive Si powder in a vapor blast cabinet. (R.J.S.)

10223 WASTE MANAGEMENT FOR SMALL RADIONUCLIDE USERS. C. A. Mawson (Environmental Research Branch, A.E.C.L., Can.). Can. Nucl. Technol., 1: No. 6, 44-7(1962).

Disposal and handling of small amounts of low-level radioactive wastes are discussed. Safety measures are described for several of the methods, which include deposition in solution into the ground, incineration, sewer disposal, burial, and dumping in municipal dumps. (T.F.H.)

10224 EXPERIMENTAL BASES FOR THE CONSTRUCTION OF THE WASTE TREATMENT INSTALLATION IN THE HOT LABORATORY OF THE EIR IN WÜRENLINGEN. II. TREATMENT OF WASTES OF MEDIUM AND HIGH ACTIVITY BY EVAPORATION. H. R. von Gunten and K. F. Eschle (EIT, Würenlingen, [Switzerland]). Neue Tech., 4: 476-82(Sept. 1962). (In German)

Laboratory experiments showed that a reflux column and a fiberglas filter-unit are very useful to improve the decontamination of vapor from an evaporator for medium and high level radioactive waste. If both filtering systems are connected in series, decontamination factors (feed/condensate) of about 10^5 can be expected. (auth)

10225 REMOVAL OF RADIOACTIVE WASTE. PART I. Ulrich O. Schanze. Wasser, Luft Betrieb, 6: 72-4; 76-8(Feb. 1962). (In German)

Radioactive waste from all institutions and plants in which radioactive material is handled must be controlled and treated before being discharged. The methods of treating and measuring radioactive waste are described. (R.J.S.)

10226 INCORPORATION OF RADIOISOTOPES INTO MELTED SILICATES. J. Rálková and J. Saidl (Nuclear Research Inst., Rez, Prague). IAEA Preprint No. SM-31/20. Vienna, International Atomic Energy Agency, 1962. (Prepublication Copy. 19p.) (In English)

The selection of melted rock and of glass-type silicate materials suitable for the incorporation of biologically dangerous and long-lived radioisotopes was investigated. Results are reported from a survey of those factors that could influence the rate of release of incorporated isotopes lest these could endanger the biosphere. As raw materials 14 sorts of basalt type melted rocks from North and West Bohemia and three sorts of selected glasses were used. In experimental study due attention was paid to the diffusion of radioisotopes in glass and melted rocks and to chemical resistance of these materials. For investigation of the diffusion of Sr^{90} and Cs^{134} the method of thin layer, described by Kryukov and Zhuchowickij, was chosen as a most advantageous one. In the temperature region of 300 to 600°C the diffusion coefficients of 10^{-13} to 10^{-11} cm^2/sec were found. The fact, that for cesium lower activation energy was found than for sodium, verifies the assumption that cesium is the least bound of all glassforming elements. By measuring the leaching rate of Cs and Sr from melted rocks the largest portion of leached radioactivity was determined in the initial phase of the leaching process. After 100 hours, the percentage of leached radioisotopes assumed the constant value. The leaching rate after a longer time is probably limited by frame-work corrosivity and by the internal diffusion of soluble elements from inside to the surface of the solid body. The corrosivity of glasses and melted rocks was examined in static arrangement at constant temperature (35, 60, and 90°C) and the leaching coefficients of 10^{-11} to 10^{-9} $cm^{-2}sec^{-1}$ (at 35°C) were found. These results show that the materials investigated are suitable substrate for the incorporation of some high-level radioactive wastes. Should high-active blocks be disposed under controlled conditions so as to exclude any possible contact with water, the safety of this disposal can be guaranteed. (auth)

10227 THE CONCENTRATION AND STORAGE OF HIGHLY ACTIVE WASTES FROM THE FIRST STAGES OF THE UK CIVIL NUCLEAR POWER PROGRAMME. D. W. Clelland (United Kingdom Atomic Energy Authority, Risley, Warrington, Eng.). IAEA Preprint No. SM-31/2. 50p. (In English)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

The general problems of highly active waste disposal are discussed, and in particular the UK system of concentrating and storing highly active waste as an acidic liquid concentrate is described. A speculative estimate is made of the amount of highly active waste which will arise from reprocessing during the first two decades of the UK Civil Nuclear Power Programme and engineering design and technical problems associated with the safe and economic confinement of this material are examined. (auth)

10228 CONCENTRATION AND STORAGE OF FISSION PRODUCTS AT THE MARCOULE PLUTONIUM EXTRACTION PLANT. M. Chambon and J. Rodier (Centre de Production du Plutonium de Marcoule, France). IAEA Preprint No. SM-31/21. 38p. (In French)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

The very highly active effluents of the Marcoule plutonium extraction plant consist mainly of the raffinate obtained in the course of the first extraction, during which nitric acid is used as salting-out agent. After washing with a diluent in a mixer-settler, the effluents are concentrated by evaporation at atmospheric pressure, the nitric acid being destroyed simultaneously by the formaldehyde. Concentration is carried out in two stages. The nitric acidity of the boiling solutions in the evaporators and the concentrate for storage is 3N. The over-all decontamination factors γ are of the order of 10^6. After final evaporation, the concentrated solution of fission products is led, by gravity, to storage installations near the plant, composed of stainless steel tanks with a useful capacity of 60 m^3. Effluents are stored at the ordinary temperature and cooled by closed-circuit water-circulation in the pool in which each tank is immersed and within internal coils. A permanent check is maintained on the volume and temperature of the stored liquids, on pressure in the storage tanks and on the activity of the cooling circuits. Before discharge into the stack, the ventilation air of the buildings is filtered through glass wool and monitored for radioactivity. After deentrainment, the ventilation air of the storage tanks is passed through paper filters before entering the waste circuit. In the event of an incident, it is possible at any moment to effect emergency transfer of the contents of a given tank into a reserve tank. If necessary, contaminated cooling water can also be sent to the Centre's effluent treatment station. The entire installation is divided into four quite distinct areas as regards radioactivity hazards. Possible soil pollution is monitored by measuring the activity of water collecting in channels round the installation. A watch is maintained on the water table by means of four tubed probes placed in a semi-circle round the store. (auth)

10229 LYOPHILIC PROCESSING OF MEDIUM-ACTIVITY LIQUID EFFLUENTS. P. Cerré (Centre

d'Etudes Nucléaires, Saclay, France). IAEA Preprint No. SM-31/22. 8p. (In French)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

One of the disadvantages associated with the method of reducing the volume of liquid effluents by evaporation is that volatile radioactive elements such as ruthenium are dispersed. On the other hand, desiccation at low temperature under vacuum makes it possible to restrict the radioactivity to the dry residue. Although the process is already known, it has not yet been applied to the various radioactive effluents encountered at atomic centres. The laboratory tests carried out show that the decontamination factor obtainable is higher than that achieved with the conventional methods of chemical treatment or evaporation. The experiments which we have carried out and which are described in the paper have given us decontamination factors in the neighborhood of 10^6. (auth)

10230 TREATMENT AND PACKAGING OF SOLID WASTE IRRADIATED IN PILE. E. Mestre (Centre d'Etudes Nucleaires, Saclay, France). IAEA Preprint No. SM-31/23. 16p. (In French)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

The solid waste produced in atomic centers varies greatly in nature, form, and activity, ranging from weakly contaminated laboratory waste to unwieldy devices irradiated in the reactor and highly radioactive Methods of treatment, packaging, and protection are described in respect to these types of waste. A pilot unit is described which was operated at Saclay for eighteen months and which has led to the construction of a remote-controlled plant for treating and packaging all kinds of solid wastes, whatever their activity and shape. (auth)

10231 THE PROBLEM OF STORING FISSION PRODUCTS ARISING FROM THE PROCESSING OF IRRADIATED URANIUM–MOLYBDENUM ALLOYS. D. Faugaras and T. Kikindai (Commissariat à l'Energie Atomique, Paris). IAEA Preprint No. SM-31/24. 20p. (In French)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

Uranium–molybdenum alloys are of value thanks to their in-pile behaviour, but serious disadvantages arise in connection with the storing of fission products resulting from the processing of these alloys. Because of the insolubility of molybdenum it is impossible to concentrate a solution of fission products by evaporation, and for this reason we have directed our efforts towards the solubilization of molybdenum through the addition of reagents such as iron or phosphoric ions. In this way one can obtain final solutions of 60 g/l Mo with Fe and 100 g/l Mo with PO^4H_3. The volumes to be stored are still considerable (especially with Fe) and the possibility of nitrate calcination in a fluidized bed was considered. The reaction takes place at about 400°C. The behaviour of the ruthenium and the friability of the calcined solid (formation of considerable amounts of fine material) have led us to abandon this process in favour of the preparation of phosphate glasses. (auth)

10232 VITRIFICATION OF CONCENTRATED SOLUTIONS OF FISSION PRODUCTS: STUDY OF GLASSES AND THEIR CHARACTERISTICS. R. Bonniaud, C. Sombret, and F. Laude (Centre d'Études Nucléaires, Paris). IAEA Preprint No. SM-31/25. 36p. (In French)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

Studies were carried out on two types of high-level radioactive waste: concentrated solutions originating from non-alloyed uranium rods and solutions originating from uranium-molybdenum rods. In each of these cases, various types of glass were developed and studied in tracer, then higher-level activity amounts. Use of a hot-cell installation producing test glasses of standard activity ranging from 0.5 to 1 curie/gram made it possible to select glasses and adapt them to various technological processes, and to study gas volatility in firing and gas purification. The glasses are manufactured in the crucible, following gelation of the mass to be vitrified. Loss rate by aqueous leaching attains, under optimum conditions, 1×10^{-7} to 2×10^{-7} glass g/cm^2/day. Activity lost by volatility in firing remained low (about 0.12% of total activity). Solutions varying in age were vitrified; the activity lost by volatility is of the same order of magnitude, although slightly higher for the young solution: for the latter, the loss in ruthenium-106 amounts to 1% of total ruthenium, and in cesium-137, to 0.3% of total cesium. Gas purification is facilitated by a filter having granules of the same composition as the glass which retains at least 93% of the volatilized activity; the filter content may be re-cycled. In the case of molybdenic solutions, difficulties arose in respect of incorporating high MoO_3 contents in the glasses. Two possibilities being explored include the utilization of phosphated compositions in which incorporation of up to 30% of MoO_3 is possible, and the utilization of phospho-silico-borated compositions for which the MoO_3 content is lower. (auth)

10233 VITRIFICATION OF CONCENTRATED SOLUTIONS OF FISSION PRODUCTS: TECHNOLOGICAL STUDIES. R. Bonniaud and Rancon (Centre d'Etudes Nucléaires, Paris). IAEA Preprint No. SM-31/26. 34p. (In French)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

Vitrification in crucibles has a number of advantages including simplicity of operation and low activity loss in firing. On the other hand, the installations needed for a given output take up considerable room and the mass left to be stored is fairly large. Two processes have been developed which can give a sizeable output with installations taking up little space. One makes possible continuous vitrification, and the other semi-continuous vitrification by the method known as the pot process. The continuous vitrification installation tried out can treat about 100 liters of solution a day. It consists of a rotary calcinator coupled to a continuous fusion furnace made up of an overflow crucible heated by a resistance furnace in super-kanthal. The original overflow crucible, in regular silicon aluminum, has been replaced by one in cast zirconium silicate to be proof against the corrosive action of phosphate glasses. Operation of the installation has been by runs of about 100 hours, with a tracer activity of about 10 millicuries a day. The pot vitrification installation is a process coming between that described above and the crucible process. After glass frit and gelling clay have been added, the active solution is poured continuously into a pot at 500°C until filling is complete. Calcination and feeding go on together. The filling level is determined by measurement of internal temperatures. After the full charge is calcinated, the glass is melted and tapped through the lower end of the pot, which can thus be re-used. The pot itself, in inconel, has a cross-section of 20 cm in diameter and a height of 1 m. Items studied include composition

of the mixture, optimum feed-flow rates, possibility of separate feeding of active solution and glass frit with no prior mixing, glass tapping conditions. Work is in progress on an installation having an induction-heated pot of 2 m height and some 20 cm diameter. (auth)

10234 FIXATION OF RADIONUCLIDES IN TITANIUM DIOXYDE AND TITANATES VIA CO-PRECIPITATION. H. W. Levi (Hahn-Meitner Institut for Kernforschung, Berlin). IAEA Preprint No. SM-31/27. 7p. (In English)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

Calcination and adsorption on clay minerals are the most frequently studied ways of radionuclide fixation. Fixation via co-precipitation did not attract much interest up to now. The characteristic for all three methods is high temperature treatment of a pre-product containing the radioactivity, but they differ in introducing the activity into this pre-product. The disadvantages of co-precipitation are the difficult separation of the highly active sludge from solution and its bad qualification for cesium removal. Its advantages are the suitability for head-end-processes, the less restricted volume capacity compared with clay mineral adsorption, and the avoidance of evaporation operations. Therefore it seemed worthwhile to look more closely into the chemistry of proper co-precipitation systems. The first system chosen was $TiO_2 \cdot H_2O$ because of the good fixation qualities of TiO_2 and titanates. The co-precipitation properties of $TiO_2 \cdot H_2O$ were studied under different experimental conditions. For some radionuclides the distribution coefficient was found as good as or better than for other oxide hydrates. High concentration of the radionuclide ion or similar ions caused decreasing distribution coefficient. This could be avoided by simultaneously precipitating carbonates or oxalates which remove the bulk of the ions. The influence of high aluminum content was studied as well. An investigation of the formation of anatas and rutil from pure $TiO_2 \cdot H_2O$ precipitates and of titanates from $TiO_2 \cdot H_2O$ + carbonate or oxalate precipitates during high temperature treatment was started. (auth)

10235 FIXATION OF RADIOACTIVE WASTE IN GLASS. PART I. PILOT PLANT EXPERIENCE AT HARWELL. M. N. Elliot, R. Gayler, J. R. Grover, and W. H. Hardwick (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint No. SM-31/3. 34p. (AERE-R-4098(Pt. 1)). (In English)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

The reasons for incorporating fission product wastes into glass for long-term storage are outlined. The flowsheet and operating cycle of the fixation process which has been developed at Harwell are described. Two years of operation of an inactive pilot plant are surveyed to show how the present operating conditions have been evolved. Full-length runs under these conditions have confirmed the reliability and reproducibility of the process. Engineering components suitable for an active plant have been developed and tested and the layout of the 1000 curie pilot plant being commissioned at Harwell is illustrated in sketch form. Factors that affect the scale-up of the process are discussed in relation to the needs of the developing UK power program. (auth)

10236 FIXATION OF RADIOACTIVE WASTE IN GLASS. PART II. THE EXPERIMENTAL EVALUATION OF PHOSPHATE AND BOROSILICATE GLASSES. M. N. Elliot, J. R. Grover, and W. H. Hardwick (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint No. SM-31/4. 22p. (AERE-R-4098(Pt.II)). (In English)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

A glass suitable for long-term storage of fission product wastes must be chosen firstly with regard to the method of storage, and secondly with regard to reliability of manufacture in highly radioactive plant. The factors that are relevant to storage include leach resistance, thermal and radiation stability, and the percentage of waste that can be incorporated, while the physical and chemical nature of glass-forming additives together with the melting point and viscosity of the glass relate to the manufacturing process. The relative importance of these factors is discussed. Experimental studies of the borosilicate glasses that have been chosen for pilot plant work are described including the effect of radiation doses of up to 10^{12} rads on their physical and chemical properties. Glasses of other kinds have also been examined and their potential value as storage media is compared with the borosilicate glasses. (auth)

10237 THE FIXATION OF RADIOACTIVE WASTE IN GLASS. PART III. THE REMOVAL OF RUTHENIUM AND DUST FROM NITRIC ACID VAPOURS. M. N. Elliot, R. Gayler, J. R. Grover, and W. H. Hardwick (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IAEA Preprint No. SM-31/5. 26p. (AERE-R-4098(Pt.III)). (In English)

To be published in Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962.

The off gas from the glass fixation process contains volatile and particulate radioactive materials. To avoid a secondary effluent problem these are trapped on a filter/absorber and prevented from passing into the nitric acid condensate. The filter/absorber with its radioactive burden is incorporated in glass as it is formed in the next cycle of operation in the process vessel. The major volatile constituent is ruthenium as the tetroxide, and its formation has been studied over a range of operating temperatures and feed flowrates. Various materials suitable for the removal of ruthenium tetroxide from the off gas have been examined and the effects of the operating variables on the decontamination factor have been tested for the more promising materials. The volatility of cesium, molybdenum, and boron during the process has also been studied. Methods and equipment for the removal of dust particles from gases have been surveyed. Tests have been carried out on a range of filter materials, for use as prefilters and high efficiency absolute filters. The design of a compact, disposable, filter/absorber unit which can be incorporated into the cylinders of glass is described, together with the results of some full-scale tests. (auth)

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ARMED SERVICES TECHNICAL INFORMATION AGENCY, ARLINGTON, VA.
Bibliography on explosive forming, 17: 8752 (AD-270900)
ATLANTIC RESEARCH NUCLEAR CORP., ALEXANDRIA, VA.
Prog. rpt. on chemical radiation dosimetry, 7/62, 17: 8136 (TID-17356)
ATOMIC ENERGY OF CANADA LTD., CHALK RIVER, ONT.
Cubical array of Cs-137 γ sources for calibrating instruments, 17: 8589 (CRRD-1105)
Douglas Point nuclear generating station, 17: 10041 (AECL-1596)
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Liquid dynamics from neutron spectrometry, 17: 8919 (CRNP-1121)
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ATOMIC POWER DEVELOPMENT ASSOCIATES, INC., DETROIT.
Sodium compatibility of graphites and semi-graphites, 17: 8709 (NP-12487)
ATOMICS INTERNATIONAL. DIV. OF NORTH AMERICAN AVIATION, INC., CANOGA PARK, CALIF.
Extended time boiling with OMRE coolant, 17: 9850 (NAA-SR-Memo-5794)
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Linear power detection and recording instrument system for kinetic experiments on H_2O boilers, 17: 8590 (NAA-SR-7077)
Pulse heating of Zr–U hydrides, 17: 8808 (NAA-SR-7398)
AUSTRALIA. ATOMIC ENERGY COMMISSION.
Tenth annual report, 1961–62, 17: 7663 (NP-12329)
AVCO CORP. AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.
Active shielding, 17: 10200 (NP-12371)

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BABCOCK AND WILCOX CO., LYNCHBURG, VA.
NS *Savannah* upgrading analog computer analysis, 17: 9830 (BAW-1260)
BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Neutron transmission versus thickness for materials, 17: 9478 (BRL-1174)
BATTELLE INSTITUT E. V., FRANKFURT AM MAIN.
Prog. rpt. on corrosion of reactor materials, 7–9/62, 17: 8742 (EURAEC-448)
BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Corrosion resistance of Ni-base alloys, 17: 8740 (BMI-X-213)
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BATTELLE MEMORIAL INST. DEFENSE METALS INFORMATION CENTER, COLUMBUS, OHIO.
Thermal radiative properties of materials, 17: 8801 (DMIC-177(Vol.2))
BERN. UNIVERSITÄT.
Radioactive dating of lunar surface, 17: 8280 (N62-11797)
BOEING CO., SEATTLE.
X-ray inspection physics, 17: 10192 (AD-275297(p.173-91))
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
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BRUSSELS. CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLÉAIRE.
Prog. rpt. on fallout, 1961, 17: 8385 (A/AC.82/G/L.795)
BRUSSELS. UNIVERSITÉ.
Prog. rpt. on chemical analysis of products concerning nuclear chemistry, 7–9/62, 17: 8017 (EURAEC-484)
Prog. rpt. on metal oxidation problems in metals, 4–6/62, 17: 8745 (EURAEC-379)
BUREAU OF MINES, RENO, NEV.
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CALIFORNIA INST. OF TECH., PASADENA.
Effect of geomagnetic fluctuations on trapped particles, 17: 9167 (N62-10690)
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CALIFORNIA. UNIV., BERKELEY.
Heat capacity of liquid alloys, 17: 7999 (NP-12432)

Prog. rpt. on cosmic rays, final, 7/1/60–9/30/62, 17: 9164 (AFOSR-419)
Vapor pressure and heat of sublimation of CaF_2, 17: 8014 (UCRL-10141)

CALIFORNIA. UNIV., BERKELEY. INST. OF ENGINEERING RESEARCH.
Computers for equivalent residual dose computation, 17: 8426 (CDRP-182-107)
Equivalent residual dose in complex operational situations, 17: 8695 (CDRP-182-108)

CALIFORNIA. UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Adjustment of cyclotron magnetic field by trim coils, 17: 9651 (UCRL-10075)
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Nine-channel polychromator for observation of time-dependent spectral line profiles, 17: 8537 (UCRL-9843(Rev.))
Nuclear power potential for space vehicles, 17: 10185 (AD-275297 (p.15-17))
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CALIFORNIA. UNIV., LA JOLLA.
Prog. rpt. on plasma physics, 10/62, 17: 9687 (TID-17475)

CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Are curl-free fields necessary in guided-wave theory? 17: 8950 (UCRL-6731)
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CAMBRIDGE LANGUAGE RESEARCH UNIT, CAMBRIDGE, ENGLAND.
Theory of origin of mass within control model of elementary particles, 17: 9181 (AD-275843)

CANADA. DEPT. OF MINES AND TECHNICAL SURVEYS. MINES BRANCH.
Activation analysis with thermal or fast neutrons, 17: 7956 (NP-12437)

CARNEGIE INST. OF TECH., PITTSBURGH.
Prog. rpt. on thermal conductivity of inorganic melts, 12/15/62, 17: 8010 (TID-17767)

CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CHARLOTTE, N. C.
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Prog. rpt. on CVTR project, 8/62, 17: 10075 (WCAP-4128)
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CATHOLIC UNIV. OF AMERICA, WASHINGTON, D. C.
Gamma activation analysis by Am–Be and Pu–Be source, 17: 7953 (CUA-NE-24)

CENTRO INFORMAZIONI STUDI ESPERIENZE, MILAN.
Design of high-pressure gas circulator, 17: 8274 (EURAEC-480)
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CHICAGO. UNIV. INST. FOR THE STUDY OF METALS.
Extinction and diffuse neutron intensity measurements, 17: 8518 (BNL-6052)

CHILE. UNIVERSIDAD, SANTIAGO.
Neutron flux of reaction $C^{13}(d,n)N^{14}$, 17: 9505 (NP-12441)
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COLORADO SCHOOL OF MINES RESEARCH FOUNDATION, INC., GOLDEN.
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COLUMBIA UNIV., NEW YORK.
Prog. rpt. on electromagnetic spectrum, 6–9/62, 17: 8928 (NP-12325)
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Prog. rpt. on fluid flow and heat transfer, 12/62, 17: 8328 (TID-17702)

COLUMBIA UNIV., PALISADES, N. Y. LAMONT GEOLOGICAL OBSERVATORY.
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COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
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COMPAGNIE INDUSTRIELLE DES COMBUSTIBLES ATOMIQUES FRITTES, CORBEVILLE, PAR ORSAY (SEINE-ET-OISE), FRANCE.
Prog. rpt. on UO_2 extrusion, 17: 8754 (EURAEC-52)

CONNECTICUT. UNIV., STORRS.
Prog. rpt. on radiation effects on protozoa and mammals, 12/1/61–11/1/62, 17: 7800 (TID-17580)

CONSOLIDATION COAL CO. RESEARCH AND DEVELOPMENT DIV., LIBRARY, PENNA.
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DENVER. UNIV. DENVER RESEARCH INST.
Molybdenum and effects of additions of Y, 17: 8811 (NP-12481)

DIVISION OF REACTOR DEVELOPMENT, AEC.
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DU PONT DE NEMOURS (E. I.) & CO. METALS CENTER, BALTIMORE.
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DUQUESNE LIGHT CO., SHIPPINGPORT, PENNA.
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FLORIDA STATE UNIV., TALLAHASSEE.
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FORD MOTOR CO., DEARBORN, MICH.
Infrared spectra of RuF_5 and RhF_5, 17: 8007 (TID-17667)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Bibliography on reactor safety fuse devices, 17: 9834 (CEA-BIB-19)
Theory of pairing correlations, 17: 9817 (NP-12352)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE DE PRODUCTION DE PLUTONIUM DE MARCOULE, CHUSCLAN.
Radiation protection in Marius, 17: 9832 (CEA-2200)
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FRANKLIN INST., PHILADELPHIA.
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GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
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Testing of D102 A2 power plant, 17: 10047 (DC-59-4-710)
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Control rod drive for BWR, 17: 9842 (GEAP-3481)
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Correlations for rise velocity of cylindrical bubbles in vertical tubes, 17: 8318 (62GL130)
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Absolute measurement of W_{air} for Co-60 γ secondaries, 17: 8921 (HW-SA-2511)
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GENERAL ELECTRIC CO. MISSILE AND SPACE DIV., VALLEY FORGE SPACE TECHNOLOGY CENTER, KING OF PRUSSIA, PENNA.
Interaction of EM waves with nonuniform plasma flows, 17: 9685 (R62SD14)
GENERAL ELECTRIC CO. RESEARCH LAB., SCHENECTADY, N. Y.
Ionization in high-pressure Cs–He transient discharge, 17: 9669 (62-RL-3122E)
Magnetic compression of collision-free plasma. III., 17: 9670 (62-RL-3169E)
Nonequilibrium ionization in discharges at elevated pressures, 17: 9668 (62-RL-3113E)
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Calibration of high-altitude air flowmeter, 17: 8535 (TID-17592)
Prog. rpt. on sputtering yields, 11/61–10/62, 17: 8931 (NP-12389)
Remote handling technology and equipment, 17: 8273 (AFSWC-TDR-62-117)
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Bonus reactor pressure vessel, 17: 10050 (GNEC-210(Suppl.2))
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Heavy water moderated reactors evaluation, design, 17: 10057 (NP-12344(Vol.II))

Heavy water moderated reactors evaluation, plant designs, 17: 10058 (NP-12344(Vol.III))
GENOA. UNIVERSITÀ. ISTITUTO DI FISICA.
Energy loss of fast electrons in bubble chamber, 17: 9184 (CNEN-160)
GEOPHYSICS CORP. OF AMERICA, BEDFORD, MASS.
Prog. rpt. on determining distribution of radioactive material in upper atmosphere, 6–9/62, 17: 8389 (NYO-10392)
GEORGIA INST. OF TECH., ATLANTA. ENGINEERING EXPERIMENT STATION.
Prog. rpt. on high-temperature materials, 7–9/62, 17: 8814 (TID-17530)
GHENT. RIJKSUNIVERSITEIT.
Prog. rpt. on stainless plating of steels, 7–9/62, 17: 8758 (EURAEC-458)
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GOODYEAR ATOMIC CORP., PORTSMOUTH, OHIO.
Granular material sampler, 17: 8524 (GAT-T-927)
Hexafluorides of Mo, W and U. III., 17: 7993 (GAT-T-971)
GT. BRIT. AGRICULTURAL RESEARCH COUNCIL. RADIOBIOLOGICAL LAB., WANTAGE, BERKS, ENGLAND.
Annual rpt., 1961–62, 17: 7785 (ARCRL-8)
GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE, HARWELL, BERKS, ENGLAND.
Two-stage separated beam systems, 17: 8927 (NIRL/R/18)

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HAHN-MEITNER-INSTITUT FUR KERNFORSCHUNG BERLIN.
Prog. rpt. on diffusion of inert gases in solid bodies, 6–8/62, 17: 8822 (EURAEC-457)
HARVARD UNIV., BOSTON.
Performance of Mikro-Pulsaire collector, 17: 8282 (NYO-4816)
HARVARD UNIV., CAMBRIDGE, MASS.
Atomic and electronic collision processes, 17: 8914 (AFCRL-62-475)
HEBREW UNIV., JERUSALEM.
Absorption spectrum of Yb in single crystal of CaF_2, 17: 8915 (AFCRL-62-628)
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ILLINOIS INST. OF TECH., CHICAGO. ARMOUR RESEARCH FOUNDATION.
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ILLINOIS. UNIV., URBANA.
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ILLINOIS. UNIV., URBANA. ENGINEERING EXPERIMENT STATION.
Fluctuations in plasma and wave properties, 17: 9671 (AFCRL-62-340)
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Application of isotope techniques in hydrology, 17: 8512
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STRETCH master control program, 17: 8698 (LADC-5548)
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Time variations of intensity in earth's inner radiation zone, 17: 9169 (SUI-62-1)
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Nuclear debris in precipitation, 17: 7772 (NYO-9533)
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ISRAEL. ATOMIC ENERGY COMMISSION, REHOVOTH.
Photometric determination of Sr and Ba, 17: 7955 (IA-770)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ISPRA.
Ionic conductivity during deformation of alkali halides, 17: 8003 (RT/CNI(62)4)
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ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE. LABORATORI NAZIONALI, FRASCATI.
Measurement of polarization of μ mesons, 17: 9193 (LNF-62/61)
Pulsed oscillator for time measurement, 17: 8533 (RT/EL(62)-13)
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ITALY. ISTITUTO NAZIONALE DI FISICA NUCLEARE, TURIN.
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JOHNS HOPKINS UNIV., BALTIMORE.
Accidents to potential highway carriers of radioactive materials, 17: 8431 (NYO-9771)
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JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Angular distributions for $C^{12}(t,\alpha_0)B^{11}$, 17: 9503 (JINR-P-1098)
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Fuel assembly and heat transfer for EGCR. III., 17: 10060 (TID-11602)
Fuel assembly and heat transfer for EGCR. II., 17: 8324 (TID-11603)
KERNFORSCHUNGSZENTRUM, KARLSRUHE, GERMANY.
Glasses for dosimetry, 17: 8603 (CEA-tr-A-1208)
KERNREAKTOR BAU- UND BETRIEBS-GESELLSCHAFT M.B.H., KARLSRUHE, GERMANY.
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Fast neutron flux profiles of polyethylene septa critical configurations, 17: 9481 (TID-15547)
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LAKE CITY ARSENAL, INDEPENDENCE, MO.
Fluoroscopic techniques of fuze evaluation, 17: 10190 (AD-275297 (p.116-20))
LITTLE (ARTHUR D.) INC., CAMBRIDGE, MASS.
Prog. rpt. on high-temperature insulation materials, 11/15/62, 17: 8809 (NP-12326)
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Absolute mass rate flowmeter, 17: 8529 (LA-2812)

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MARTIN-MARIETTA CORP. AEROSPACE DIV., BALTIMORE.
Prog. rpt. on PM-3A nuclear power plant, 8/61–2/62, 17: 10054 (MND-M3A-2452)
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Final rpt. on radiation processing of foods, 6/61–5/62, 17: 8491 (NYO-10412)
Irradiation of Santowax OMP. II., 17: 8885 (MITNE-22)
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Radiation effects on crystal growth rate, 17: 8137 (TID-17583)
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MATERIALS RESEARCH CORP., ORANGEBURG, N. Y.
Prog. rpt. on Fe single crystal preparation, 7–10/62, 17: 8707 (MRC-341)
METALLGESELLSCHAFT A. G., FRANKFURT AM MAIN.
Prog. rpt. on effects of neutrons on Zr–Nb–Sn, 7–9/62, 17: 8890 (EURAEC-494)
MICHIGAN. UNIV., ANN ARBOR.
Boundary value problems in plasma, 17: 9683 (NP-12456)
Neutron acoustodynamics, 17: 9195 (NP-12399)
Prog. rpt. on low heat-flux boiling, 4/1–10/1/62, 17: 8329 (TID-17783)
Three soluble problems in linear transport theory, 17: 9480 (NP-12458)
MILAN. UNIVERSITÀ.
Prog. rpt. on energetics transfer in photodynamic reaction, 11/62, 17: 7798 (TID-17544)
MINNESOTA. UNIV., MINNEAPOLIS.
Dynamic properties of Langmuir probes, 17: 9673 (ARL-62-417)
Prog. rpt. on heat transfer, 11/62, 17: 8326 (TID-17525)
Prog. rpt. on linear accelerator program, 12/61–11/62, 17: 9649 (TID-17578)
MOL, BELGIUM. CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLÉAIRE.
Detectors sensitive to γ polarization, 17: 8591 (NP-12340)
Prog. rpt. on H_2O treatment and radioactive waste, 4–6/62, 17: 10220 (EURAEC-367)
Prog. rpt. on physical properties of UO_2 single crystals, 4–6/62, 17: 8802 (EURAEC-381)
Prog. rpt. on properties of UO_2, 7–9/62, 17: 8804 (EURAEC-463)
Prog. rpt. on solid state neutron detector, 1–3/62, 17: 8882 (EURAEC-306)
Prog. rpt. on water and radioactive residue treatment, 7–9/62, 17: 10221 (EURAEC-443)
MONSANTO RESEARCH CORP. DAYTON LABS., OHIO.
Prog. rpt. on shielding materials, 11/61, 17: 9812 (AD-272874L)
Prog. rpt. on thermoelectric generator, 10–12/62, 17: 8944 (NP-12477)
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Prog. rpt. on research, 4/62, 17: 7659 (MLM-1136)
Prog. rpt. on research, 5/62, 17: 7660 (MLM-1137)
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Prog. rpt. on research, 7/62, 17: 7662 (MLM-1139)

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
Conference on space exploration. I., 17: 7674
Hydromagnetic wave propagation in constant dipole magnetic field, 17: 9678 (NASA-TN-D-1689)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Interstellar radiation field, 17: 9168 (N62-12904)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, HAMPTON, VA.
Irradiation effects of protons on transistors, 17: 8887 (NASA-TN-D-1490)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Applying field-ion emission to electrostatic rocket engines, 17: 10197 (NASA-TN-D-1563)
Cesium ion rocket with large W ionizer, 17: 10196 (N62-12872)
Compatibility of molten UO_2 with refractory materials, 17: 8743 (NASA-TN-D-1442)
Mock-up reactor, NASA Plum Brook facility, 17: 10130 (NP-12379)
Propulsion for orbital launch of nuclear rockets, 17: 10198 (NASA-TR-R-140)
NATIONAL CARBON CO., FOSTORIA, OHIO.
Graphite-matrix nuclear fuel elements, 17: 8712 (TID-17593)
NATIONAL CARBON CO., PARMA, OHIO.
Graphite-matrix nuclear fuel elements, 17: 8712 (TID-17593)
NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Stripping of U from TBP–kerosene solvent into H_2O, 17: 8245 (NLCO-852)
NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA.
Absorption spectrum of Yb in single crystal of CaF_2, 17: 8915 (AFCRL-62-628)
NAVAL AMMUNITION DEPOT, CONCORD, CALIF.
Accelerator for radiography of rocket motors, 17: 10191 (AD-275297 (p.131-49))
Missiles and rockets symposium, Concord, Calif., 4/61, 17: 10184 (AD-275297)
NAVAL ORDNANCE LAB., CORONA, CALIF.
Fast neutron radiography, 17: 10189 (AD-275297(p.112-15))
NAVAL ORDNANCE LAB., WHITE OAK, MD.
Fourier projections of unpaired electron densities, 17: 8918 (BNL-5902)
NAVAL ORDNANCE TEST STATION, INYOKERN (CHINA LAKE), CALIF.
Propulsion unit inspection with detectors, 17: 10188 (AD-275297(p.70-4))
NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Gamma rays of In-115, 17: 9518 (USNRDL-TR-593)
Late effects of fractionated x radiation in mice, 17: 7804 (USNRDL-TR-595)
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Quaternion approach to elementary particle theory. I., 17: 8934 (NP-12415(p.7-21))
Reaction $Li^7(He^3,\alpha)Li^8$, 17: 8933 (NP-12415(p.1-3))
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Transformation of complex cosmic-ray nuclei in galactic space, 17: 8936 (NP-12415(p.30-9))
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Prog. rpt. on pressure vessels, 7–9/62, 17: 8716 (EURAEC-498)
NETHERLANDS. NIJVERHEIDSORGANISATIE, TNO, THE HAGUE.
Prog. rpt. on determination of ductile-brittle transition temperature, 4–6/62, 17: 8803 (EURAEC-398)
NEW HAMPSHIRE. UNIV., DURHAM.
Prog. rpt. on radiation-induced mutations in honey bee, 17: 7799 (TID-17579)
NEW MEXICO. UNIV., ALBUQUERQUE. ENGINEERING EXPERIMENT STATION.
Thermal shock on thin-walled cylinder, 17: 8382 (TID-17434)
NEW YORK BOTANICAL GARDEN, NEW YORK.

Prog. rpt. on radiation effects on plants, 1962, 17: 7795 (TID-17446)
NEW YORK. STATE UNIV., NEW YORK. DOWNSTATE MEDICAL CENTER.
Radiation effects on responses to antigen, 17: 7802 (TID-17650)
NEW YORK UNIV., NEW YORK.
Finite difference scheme for Neumann and Dirichlet problem, 17: 8701 (NYO-9760)
Prog. rpt. on interaction of radiation with matter, 12/62, 17: 8138 (TID-17674)
Prog. rpt. on molten salts, 1/7/63, 17: 8008 (TID-17673)
NEW YORK UNIV., NEW YORK. ATOMIC ENERGY COMMISSION COMPUTING AND APPLIED MATHEMATICS CENTER.
Generalized overrelaxation method for operator equations, 17: 8700 (NYO-9192)
NEW YORK UNIV., NEW YORK. COURANT INST. OF MATHEMATICAL SCIENCES.
Generalized overrelaxation method for operator equations, 17: 8700 (NYO-9192)
NEW ZEALAND. INST. OF NUCLEAR SCIENCES, LOWER HUTT.
Detectors sensitive to γ polarization, 17: 8591 (NP-12340)
Deuterium abundance in hydrothermal areas in New Zealand, 17: 8929 (NP-12335)
NORDISK INSTITUT FOR TEORETISK ATOMFYSIK, COPENHAGEN.
Dispersion relations, 17: 9197 (NP-12449)
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Statistical thermodynamics, 17: 8943 (NP-12450)
Theory of particles and fields, 17: 9198 (NP-12452)
NORTH ATLANTIC TREATY ORGANIZATION, PARIS. ADVISORY GROUP FOR AERONAUTICAL RESEARCH AND DEVELOPMENT.
Gas-plasma research, 17: 9681 (AGARD-320)
NORTHWESTERN UNIV., EVANSTON, ILL.
Measurement of temperature in transparent plasmas, 17: 9672 (AFOSR-1100)
Radiation effects on shock in EM tubes, 17: 8917 (AFOSR-1101)
NUCLEAR CROSS SECTIONS ADVISORY GROUP, AEC.
Requests for nuclear cross section measurements, 17: 9519 (WASH-1040)
NUCLEAR METALS, INC., CONCORD, MASS.
Prog. rpt. on fabrication of Be, 10/62, 17: 8756 (NMI-9701.3)
Prog. rpt. on metallurgy, 9/62, 17: 8708 (NMI-2110)
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Prog. rpt. on decontamination solutions for metals in GCR, 11/59–7/62, 17: 8247 (ORNL-3308)
Prog. rpt. on geologic aspects of Th recovery, 9–11/62, 17: 8220 (TID-17519)
Solid sample preparation for infrared spectrophotometer, 17: 7961 (TID-17520)
Transport properties of dissociating gaseous mixtures, 17: 8000 (ORNL-TM-440)
OFFICE OF TECHNICAL SERVICES, WASHINGTON, D. C.
Bibliography on ultrasonics, 17: 7673

P

PARAMETRICS, INC., WALTHAM, MASS.
Prog. rpt. on Kr-85 as tracer, 7–9/62, 17: 8139 (TID-17765)
PARMA, ITALY. UNIVERSITÀ.
Energy loss of fast electrons in bubble chamber, 17: 9184 (CNEN-160)
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Field ion microscope, 17: 8530 (NP-12485)
Prog. rpt. on element accumulation by maize, 11/19/62, 17: 7751 (TID-17552)
PENNSYLVANIA. UNIV., PHILADELPHIA.
Evaluation of ferrite materials for synchrotron, 17: 8009 (TID-17687)
Prog. rpt. on optical and microwave investigations of solids, 17: 8948 (TID-17398)
PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.
Aqueous process for Zr alloy fuels. I., 17: 8242 (IDO-14594)
Control rod and driver fuel tests, EOCR, 17: 10052 (IDO-16811)
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PITTSBURGH. UNIV.
Prog. rpt. on radioecology of small vertebrate species, 1/1–11/1/62, 17: 7797 (TID-17502)
PLASMADYNE CORP., SANTA ANA, CALIF.
Properties of plasmas pertaining to arc jets, 17: 9674 (ASD-TDR-62-451)
POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR PHYSICS, KRAKOW.
Energy dependence of deuteron elastic scattering, 17: 9506 (PAN-202)
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POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH. WARSAW.
Anion exchange resins, 17: 8250 (PAN-337/IV)
Asymmetry in low multiplicity jets in nuclear emulsions, 17: 9200 (PAN-342/VI)
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X-ray camera for studies of single crystals, 17: 8531 (PAN-333/I-B)
PRINCETON UNIV., N. J.

Diffusivity and solubility in two-phase systems, 17: 7996 (MATT-148)
Prog. rpt. on Project Matterhorn, 4–6/62, 17: 9676 (MATT-Q-19)

R

RADIATION APPLICATIONS INC., LONG ISLAND CITY, N. Y.
Prog. rpt. on radiation-induced gelation, 5/61–10/62, 17: 8135 (RAI-311)
RADIO CORP. OF AMERICA. ELECTRON TUBE DIV., LANCASTER, PENNA.
Prog. rpt. on thermionic converter, 1–3/62, 17: 8912 (AD-277042)
RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Prog. rpt. on corrosion of rare earth and Y metals, 12/62, 17: 8744 (TID-17585)
RICE UNIV., HOUSTON, TEX.
Prog. rpt. on geologic aspects of Th recovery, 9–11/62, 17: 8220 (TID-17519)
ROCHESTER, N. Y. UNIV.
Energy dependence of fragmentation of cosmic ray nuclei, 17: 9152 (NYO-10249)
RÖNTGEN TECHNISCHE DIENST N. V., ROTTERDAM.
Prog. rpt. on non-destructive welding, 7–9/62, 17: 8821 (EURAEC-450)

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Antiferroelectric region of $PbHfO_3$–$PbTiO_3$–$PbSnO_3$–$PbNb_2O_6$ system, 17: 8813 (SCTM-224-62(11))
Gamma photoconductivity in organic dielectrics, 17: 8006 (TID-16040)
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SARGENT AND LUNDY, CHICAGO.
Defense capabilities of nuclear and coal-fired power plants, 17: 7656 (BNL-6080)
SAVANNAH RIVER OPERATIONS OFFICE, AEC.
Prog. rpt. on heavy water reactors, 12/62, 17: 10059 (SRO-76)
SIEMENS-SCHUCKERTWERKE A. G., ERLANGEN, GERMANY.
Prog. rpt. on ZrH in Zy-2 and ZrNb alloys, 7–9/62, 17: 8715 (EURAEC-451)
SOCIÉTÉ NATIONALE D'ÉTUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION, SURESNES, FRANCE.
Prog. rpt. on heat transfer in reactors, 6/62, 17: 8331 (EURAEC-386)
SOUDOMETAL, S. A., BRUSSELS.
Prog. rpt. on stainless plating of steels, 7–9/62, 17: 8758 (EURAEC-458)
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SOUTHERN RESEARCH INST., BIRMINGHAM, ALA.
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ä	becomes	ae
ö		oe
ø		oe
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Bureau of Naval Weapons Missiles and Rockets Symposium, Concord, Calif., Apr. 18–21, 1961, 17: 10184 (AD-275297)
Conference on Radiation-Induced Changes in Properties of Materials, Tomsk, USSR, November 1961, summary, 17: 8145
International Conference on High-Energy Physics, Geneva, July 4–11, 1962, 17: 9303
Isotope Technology Development Program Fourth Annual Contractors Meeting, ORNL, Oak Ridge, Tenn., December 3 and 4, 1962, 17: 8492 (TID-7640)
Plasma Hydromagnetics, Palo Alto, Calif., Dec. 15-16, 1961, 17: 9785
Programming and Utilization of Research Reactors, Vienna, October 16–21, 1961, 17: 10140
Radiative Transfer from Solid Materials, Boston, Dec. 12 to 13, 1960, 17: 8377
Science and Technology of Space Exploration, Vol. 1, Chicago, Nov. 1962, 17: 7674
Symposium on Rhenium of the Electrothermics and Metallurgy Div. of the Electrochemical Society, May 3-4, 1960, Chicago, Ill., 17: 8725
Topics in Radiofrequency Spectroscopy, Varenna, Italy, Aug., 1960, 17: 8093
Twelfth Meeting of the Scientific Council of the Joint Institute for Nuclear Investigations, Dubna, May 1962, summary, 17: 9211

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97	17-8515	Dep.(mc)
AEC-tr–		
5445	17-8432	Dep.; $4.50(OTS)
5601	17-8016	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
AECL–	**(Canadian)**	
1448	17-7985	See CRRL-1069
1551	17-8881	See CRFD-1118
1576	17-8919	See CRNP-1121
1596	17-10041	Dep.; $2.00(AECL)
1628	17-8589	See CRRD-1105
1631	17-10044	See CRARE-1108
1646	17-10099	34p. of "Heavy Water Moderated Natural Uranium Power Reactors." Sixth World Power Conference, Melbourne, Oct. 20-27, 1962
1648	17-9529	Can. J. Chem. 41: 123-33(1963)
1653	17-10126	See CRDC-1126
AEEW-M–	**(British)**	
221	17-9827	Dep.; $0.77(BIS); 5s. 6d.(HMSO)
AEEW-R–	**(British)**	
184	17-9828	Dep.; $0.42(BIS); 3s.(HMSO)
192	17-9829	Dep.; $0.42(BIS); 3s.(HMSO)
193	17-10042	Dep.; $0.84(BIS); 6s.(HMSO)
210	17-8692	Dep.; $0.35(BIS); 2s. 6d.(HMSO)
AERE-I–	**(British)**	
M-15	17-7938	Dep.(mc)
AERE-R–	**(British)**	
3704	17-8489	Dep.; $0.70(BIS); 5s.(HMSO)
4074	17-8516	Dep.; $0.70(BIS); 5s.(HMSO)
4094	17-8425	Dep.; $0.98(BIS); 7s.(HMSO)
4098(Pt.I)	17-10235	Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct.8-13, 1962
4098(Pt.II)	17-10236	Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct. 8-13, 1962
4098(Pt.III)	17-10237	Proceedings of the IAEA Symposium on the Treatment and Storage of High-Level Radioactive Wastes, Vienna, Oct.8-13, 1962
4187	17-7939	Dep.; $0.25(BIS); 1s. 9d.(HMSO)
AFCRL–	**(Non-AEC)**	
62-176	17-9677	See ML-897
62-260	17-9162	
62-316	17-8877	$1.60(OTS)
62-340	17-9671	$9.10(OTS)
62-475	17-8914	$4.60(OTS)
62-484	17-9163	$2.60(OTS)
62-627	17-7987	$2.60(OTS)
62-628	17-8915	$1.60(OTS)
1049	17-8916	
AFOSR–	**(Misc.)**	
419*	17-9164	$1.10(fs) OTS
1100*	17-9672	$9.60(OTS)
1101*	17-8917	$6.60(OTS)
2702*	17-9181	See AD-275843
2871*	17-9182	$2.60(OTS)
AFSWC-TDR–	**(Non-AEC)**	
62-117	17-8273	
AFSWC-TR–	**(Non-AEC)**	
60-8	17-8913	See AD-278170
AGARD–	**(Non-AEC)**	
320	17-9681	
AGN-TM–		
398	17-10043	Dep.; $2.75(OTS)
AMP–	**(Non-AEC)**	
94	17-10200	See NP-12371
ANL–		
6495	17-8798	Dep.; $0.75(OTS)
6537	17-8517	Dep.; $1.00(OTS)
6598	17-9498	Dep.; $2.50(OTS)
6600	17-7655	Dep.(mc); $15.50(fs), $7.22(mf) OTS
6616	17-10124	Dep.; $2.50(OTS)
6623	17-9499	Dep.; $2.50(OTS)
6641	17-8693	Dep.; $1.75(OTS)
6645	17-8319	Dep.; $0.50(OTS)
6647	17-9183	Dep.; $1.75(OTS)
ANL-FGF–		
386	17-8380	Dep.(mc); $2.60(fs), $0.89(mf) OTS
397	17-8799	Dep.(mc); $1.60(fs), $0.80(mf) OTS
ANLAD–		
53	17-9648	See TID-17415

Report No.	Abstract No.	Availability
APGC-TDR-	(Non-AEC)	
62-27	17-8586	$1.10(OTS)
ARCRL-	(British)	
8	17-7785	Dep.(mc); $0.91(BIS); 6s. 6d.(HMSO)
ARF-	(Misc.)	
1184-7	17-7988	Dep.(mc); $4.60(fs), $1.64(mf) OTS
ARL-	(Non-AEC)	
62-417	17-9673	OTS
ASD-TDR-	(Non-AEC)	
62-451	17-9674	OTS
AWRE-NR-	(British)	
P-4/62	17-8587	Dep.
BAW-	(Misc.)	
1260	17-9830	Dep.; $2.75(OTS)
BLG-	(Belgian)	
143	17-9897	p.347-55 of "Third International Analogue Computation Meetings, Opatija, Sept. 5-8, 1961." Brussels, Presses Académiques Européennes, 1962
BM-RI-	(Misc.)	
6131*	17-8231	Free(Bureau of Mines)
BMI-	(Misc.)	
1606	17-8490	Dep.; $1.50(OTS)
BMI-X-		
213	17-8740	Dep.(mc); $2.60(fs), $0.89(mf) OTS
BNL-		
719(Vol.II)(p.485-548)	17-9848	See KFK-108
747	17-9628	Dep.; $0.75(OTS)
760	17-8694	Dep.; $2.00(OTS)
5479	17-8232	Dep.(mc); $3.60(fs), $1.19(mf) OTS
5847	17-9629	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5902	17-8918	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5909	17-9165	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5915	17-7786	Dep.(mc); $2.60(fs), $0.92(mf) OTS
5924	17-9477	Dep.(mc); $3.60(fs), $1.40(mf) OTS
5953	17-7787	Dep.(mc); $8.10(fs), $2.72(mf) OTS
5976	17-7747	Dep.(mc); $4.60(fs), $1.67(mf) OTS
6018	17-7906	Dep.(mc); $3.60(fs), $1.22(mf) OTS
6025	17-7766	J. Histochem. Cytochem. 10: 601-10(1962)
6032	17-8121	Dep.(mc); $3.60(fs), $1.28(mf) OTS
6039	17-8233	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6041	17-7844	Intern. Con. Record 9: 49-56(1961)
6046	17-8320	Dep.(mc); $5.60(fs), $1.85(mf) OTS
6051	17-8878	Dep.(mc); $2.60(fs), $1.04(mf) OTS
6052	17-8518	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6053	17-8879	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6055	17-8880	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6059	17-7989	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6062	17-9831	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6079	17-8122	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6080	17-7656	Dep.; $2.75(OTS)
6107	17-7765	J. Gerontol. 17: 353-8(1962)
6140	17-8519	Dep.(mc); $4.60(fs), $1.64(mf) OTS
6141	17-8234	Dep.(mc); $2.60(fs), $0.89(mf) OTS
6159	17-7990	Dep.(mc); $2.60(fs), $0.89(mf) OTS
6160	17-10125	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6161	17-8123	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6165	17-7788	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6173	17-8321	Dep.(mc); $2.60(fs), $0.92(mf) OTS
6303	17-8899	Nature 196: 827-9(1962)
6389	17-9584	Phys. Rev. Letters 9: 429-30(1962)
6420	17-9630	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6424	17-9631	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6425	17-9632	Dep.(mc); $2.60(fs), $1.10(mf) OTS
6426	17-9633	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6427	17-9634	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6428	17-9635	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6429	17-9636	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6430	17-9637	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6431	17-9638	Dep.(mc); $2.60(fs), $0.86(mf) OTS
6432	17-9639	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6433	17-9640	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6434	17-9641	Dep.(mc); $3.60(fs), $1.25(mf) OTS
6435	17-9642	Dep.(mc); $2.60(fs), $0.92(mf) OTS
6436	17-9643	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6438	17-8520	Dep.(mc); $2.60(fs), $0.83(mf) OTS
6439	17-8521	Dep.(mc); $6.60(fs), $2.24(mf) OTS
6440	17-8522	Dep.(mc); $3.60(fs), $1.37(mf) OTS
6442	17-8588	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6443	17-8523	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6536	17-9263	Phys. Rev. Letters 9: 509-11(1962)
6583	17-7991	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6589	17-7992	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6595	17-7789	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6607	17-8124	Dep.(mc); $1.60(fs), $0.80(mf) OTS
BNL-T-		
282	17-8694	See BNL-760
BR-		
225R	17-9629	See BNL-5847
BRL-	(Misc.)	
1174*	17-9478	
BSD-TDR-	(Non-AEC)	
62-237	17-9675	
CAL-	(Non-AEC)	
86-P	17-8800	
CDRP-	(Non-AEC)	
182-107	17-8426	
182-108	17-8695	
CEA-	(French)	
2137	17-8720	J. Nucl. Mater., 3: 237-8(1961)
2200	17-9832	Dep.(mc)
2205	17-9833	Dep.(mc)
CEA-Bib.-	(French)	
19	17-9834	Dep.(mc)
CEA-tr-	(French)	
A-1063	17-8602	Dep.(mc); $1.10(fs), $0.80(mf) JCL
A-1100	17-8433	Dep.(mc); $1.60(fs), $0.80(mf) JCL
A-1179	17-7963	Dep.(mc); $1.60(fs), $0.80(mf) JCL
A-1208	17-8603	Dep.(mc); $3.60(fs), $1.16(mf) JCL
R-1556	17-8713	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
R-1620	17-7964	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
R-1638	17-7965	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
X-475	17-8714	Dep.(mc); $1.10(fs), $0.80(mf) JCL
CEND-	(Misc.)	
121	17-9835	Dep.(mc); $3.60(fs), $1.34(mf) OTS
CERN-	(European Organization for Nuclear Research)	
62-24	17-9644	Dep.(mc)
62-26	17-9645	Dep.(mc)

Report No.	Abstract No.	Availability
CISE-R–	**(Italian)**	
43	17-9840	See EURAEC-445
59	17-8274	See EURAEC-480
60	17-9864	See EURAEC-401
CNEN–	**(Italian)**	
160	17-9184	Dep.(mc)
CRARE–	**(Canadian)**	
1108	17-10044	Dep.; $2.00(AECL)
CRDC–	**(Canadian)**	
1126	17-10126	Dep.; $1.00(AECL)
CRFD–	**(Canadian)**	
1118	17-8881	Dep.; $0.50(AECL)
CRNP–	**(Canadian)**	
1121	17-8919	Dep.; $1.00(AECL)
CRRD–	**(Canadian)**	
1105	17-8589	$0.50(AECL)
CRRL–	**(Canadian)**	
1069	17-7985	16p. of "The Use of Ammonium Molybdophosphate for the Determination of Fission Products. Part I. The Determination of Cs-137 in Solutions of Irradiated Fuel." Sixth Conference on Analytical Chemistry in Nuclear Reactor Technology at Gatlinburg, Tenn., Oct. 9-11, 1962
CU–	**(Misc.)**	
9-62-SC-78330 Phys.*	17-8928	See NP-12325
CUA-NE–		
24	17-7953	Dep.(mc); $4.60(fs), $1.58(mf) OTS
CVNA–	**(Misc.)**	
40	17-10045	Dep.(mc); $17.50(fs), $8.39(mf) OTS
43	17-8753	Dep.(mc); $3.60(fs), $1.37(mf) OTS
133	17-9836	Dep.(mc); $19.75(fs), $9.46(mf) OTS
144	17-9837	Dep.(mc); $5.60(fs), $1.73(mf) OTS
165	17-10046	Dep.(mc); $2.60(fs), $0.89(mf) OTS
DC–	**(Misc.)**	
59-4-710	17-10047	Dep.(mc); $6.60(fs), $2.03(mf) OTS
DEG-Inf. Ser.–	**(British)**	
285	17-8604	Dep.
DLCS–		
5001062	17-10048	Dep.(mc); $5.60(fs), $1.76(mf) OTS
5001162	17-10049	Dep.(mc); $4.60(fs), $1.67(mf) OTS
DMIC–	**(Non-AEC)**	
177(Vol.2)	17-8801	
DP–		
784	17-9838	Dep.; $2.00(OTS)
788	17-8741	Dep.; $0.50(OTS)
795	17-10127	Dep.; $1.00(OTS)
811	17-8235	Dep.; $0.50(OTS)
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
EANDC-US–	**(European-American Nuclear Data Committee)**	
30"U"	17-9519	See WASH-1040

Report No.	Abstract No.	Availability
ECNG–	**(Non-AEC)**	
1062(Vol.I)	17-10056	See NP-12344(Vol.I)
1062(Vol.II)	17-10057	See NP-12344(Vol.II)
1062(Vol.III)	17-10058	See NP-12344(Vol.III)
EOS–	**(Non-AEC)**	
2080-ML-13	17-8930	See NP-12356
ETR–	**(Belgian)**	
96	17-7998	See NP-12391
100	17-8386	See NP-12392
118	17-8430	See NP-12397
EURAEC–		
52	17-8754	Dep.(mc); $1.60(fs), $0.80(mf) OTS
306	17-8882	Dep.(mc); $1.60(fs), $0.80(mf) OTS
367	17-10220	Dep.(mc); $3.60(fs), $1.19(mf) OTS
379	17-8745	Dep.(mc); $1.10(fs), $0.80(mf) OTS
381	17-8802	Dep.(mc); $2.60(fs), $0.89(mf) OTS
386	17-8331	Dep.(mc); $1.60(fs), $0.80(mf) OTS
398	17-8803	Dep.(mc); $4.60(fs), $1.61(mf) OTS
401	17-9864	Dep.(mc); $1.60(fs), $0.80(mf) OTS
406	17-9839	Dep.(mc); $3.60(fs), $1.31(mf) OTS
443	17-10221	Dep.(mc); $3.60(fs), $1.16(mf) OTS
445	17-9840	Dep.(mc); $10.50(fs), $4.31(mf) OTS
448	17-8742	Dep.(mc); $1.60(fs), $0.80(mf) OTS
450	17-8821	Dep.(mc); $3.60(fs), $1.31(mf) OTS
451	17-8715	Dep.(mc); $2.60(fs), $0.86(mf) OTS
457	17-8822	Dep.(mc); $1.10(fs), $0.80(mf) OTS
458	17-8758	Dep.(mc); $4.60(fs), $1.58(mf) OTS
463	17-8804	Dep.(mc); $3.60(fs), $1.31(mf) OTS
480	17-8274	Dep.(mc); $6.60(fs), $2.15(mf) OTS
484	17-8017	Dep.(mc); $1.60(fs), $0.80(mf) OTS
486	17-8759	Dep.(mc); $3.60(fs), $1.16(mf) OTS
492	17-9841	Dep.(mc); $1.60(fs), $0.80(mf) OTS
494	17-8890	Dep.(mc); $1.60(fs), $0.80(mf) OTS
495	17-8601	See WCAP-2117
498	17-8716	Dep.(mc); $1.60(fs), $0.80(mf) OTS
502	17-9862	See UNC-5008-II
FN-E–	**(Italian)**	
27	17-9839	See EURAEC-406
28	17-9841	See EURAEC-492
FTD-TT–	**(Non-AEC)**	
62-508	17-9691	OTS
62-1244	17-8760	OTS
GA–	**(Misc.)**	
2480	17-9758	Nucl. Fusion, Suppl., 761-6(1962)
2802	17-8883	Dep.; $2.25(OTS)
GACD–	**(Non-AEC)**	
2461	17-8920	
GAT-T–		
927	17-8524	Dep.(mc); $1.10(fs), $0.80(mf) OTS
971	17-7993	Dep.(mc); $1.10(fs), $0.80(mf) OTS
GEAP–	**(Misc.)**	
3481	17-9842	Dep.(mc); $3.60(fs), $1.19(mf) OTS
4013	17-9843	Dep.(mc); $4.60(fs), $1.64(mf) OTS
4026	17-9844	Dep.(mc); $0.75(OTS)
4086	17-8322	Dep.(mc); $2.60(fs), $0.89(mf) OTS
GNE/Phys.–	**(Non-AEC)**	
62-11	17-9680	See NP-12378
62-15	17-9682	See NP-12382
62-17	17-8584	See AD-286928
GNEC–		

Report No.	Abstract No.	Availability
210(Suppl.2)	17-10050	Dep.(mc); $8.10(fs), $2.69(mf) OTS
HW–		
59983	17-8236	Dep.(mc); $1.60(fs), $0.80(mf) OTS
64972	17-10121	Dep.(mc); $1.60(fs), $0.80(mf) OTS
67639	17-8381	Dep.; $3.60(fs), $1.25(mf) OTS
72644	17-8525	Dep.(mc); $1.10(fs), $0.80(mf) OTS
73698(Rev.)	17-8706	Dep.; $1.00(OTS)
73747(Rev.)	17-7940	Dep.; $0.75(OTS)
74210	17-8237	Dep.(mc); $1.60(fs), $0.80(mf) OTS
74731	17-10128	Dep.; $0.75(OTS)
74739	17-9845	Dep.(mc); $1.60(fs), $0.80(mf) OTS
75120	17-8805	Dep.; $0.50(OTS)
75135	17-8806	Dep.(mc); $2.60(fs), $0.92(mf) OTS
75267	17-8807	Dep.; $0.50(OTS)
75296	17-8238	Dep.(mc); $1.10(fs), $0.80(mf) OTS
75309	17-8239	Dep.; $0.50(OTS)
75384	17-7954	Dep.; $0.50(OTS)
75428	17-8884	Dep.; $0.50(OTS)
75431	17-8427	Dep.; $0.75(OTS)
75568	17-9846	Dep.(mc); $1.60(fs), $0.80(mf) OTS
HW-SA–		
2149	17-8275	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2240	17-7768	J. Occupational Med. 4: 130-2(1962)
2270	17-8276	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2276	17-8428	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2281	17-7790	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2304	17-8696	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2364	17-8240	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2388	17-8697	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2396	17-8241	Dep.(mc); $3.60(fs), $1.19(mf) OTS
2472	17-7784	p.225-32 of "Transactions of the Twenty-Seventh North American Wildlife and Natural Resources Conference." Washington, D. C., Wildlife Management Institute, 1962
2511	17-8921	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2516	17-9500	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2523	17-8526	Dep.(mc); $2.60(fs), $0.83(mf) OTS
2600	17-7748	Health Phys., 8: 615-20(1962)
2647	17-8632	Rev. Sci. Instr. 33: 1335-7(1962)
2648	17-9620	To be published in NAS-NS-3107
2649	17-8766	Welding J. (N. Y.) 42: 13-22(1963)
2831	17-9887	Nucleonics 21: No. 1, 48-52(1963)
2853	17-7683	Dep.(mc); $1.60(fs), $0.80(mf) OTS
IA–	**(Non-AEC)**	
770	17-7955	Dep.(mc)
IDO–		
11104	17-8126	See MITNE-21
11105	17-8885	See MITNE-22
14594	17-8242	Dep.; $1.00(OTS)
14595	17-10218	Dep.; $0.75(OTS)
16807	17-10051	Dep.; $2.25(OTS)
16811	17-10052	Dep.; $2.25(OTS)
16817	17-7657	Dep.(mc); $8.60(fs), $3.17(mf) OTS
28592	17-10053	Dep.(mc); $7.60(fs), $2.45(mf) OTS
IHR–		
112	17-8520	See BNL-6438
113	17-8521	See BNL-6439
114	17-8522	See BNL-6440
116	17-8588	See BNL-6442
117	17-8523	See BNL-6443
INS-R–	**(New Zealand)**	
15	17-8929	See NP-12335
16	17-8591	See NP-12340
IS–		
443	17-7994	Dep.(mc); $1.60(fs), $0.80(mf) OTS
461	17-8058	J. Chem. Phys. 37: 2610-15(1962)
464	17-8277	Dep.; $0.50(OTS)
471	17-8719	J. Appl. Phys. 34: 352-5(1963)
507	17-7995	Dep.; $0.50(OTS)
546	17-9034	Phys. Rev. Letters, 9: 370-4(1962)
590	17-9501	Dep.(mc); $8.60(fs), $3.14(mf) OTS
JAERI–	**(Japanese)**	
1028	17-10129	Dep.(mc)
1036	17-8125	Dep.(mc)
1037	17-8922	Dep.(mc)
1038	17-8243	Dep.(mc)
1039	17-8244	Dep.(mc)
JINR–	**(Russian)**	
D-1107	17-9185	Dep.(mc)
E-1067	17-8923	Dep.(mc)
E-1069	17-9289	Zh. Eksperim. i Teor. Fiz., 43: 2204-7 (1962)
P-1026	17-9284	Zh. Eksperim. i Teor. Fiz., 43: 2015-18 (1962)
P-1063	17-8527	Dep.(mc)
P-1068	17-9502	Dep.(mc)
P-1076	17-9188	Dep.(mc)
P-1087	17-9189	Dep.(mc)
P-1093	17-9190	Dep.(mc)
P-1098	17-9503	Dep.(mc)
P-1110	17-9191	Dep.(mc)
P-1112	17-9166	Dep.(mc)
JPL-TR–	**(Non-AEC)**	
32-171	17-8924	
32-201	17-10195	
32-217	17-9847	
K–		
1445	17-8528	Dep.; $0.50(OTS)
1535	17-8323	Dep.; $0.50(OTS)
KFK–	**(German)**	
108	17-9848	Dep.(mc)
LA–		
2712	17-8925	Dep.; $2.75(OTS)
2761	17-8278	Dep.; $2.00(OTS)
2769	17-8755	Dep.; $1.00(OTS)
2812	17-8529	Dep.; $0.50(OTS)
LADC–		
4589	17-8554	See TID-12910
4824	17-9748	See TID-13892
4888	17-8541	See TID-13875
4889	17-8965	Bull. Inst. Intern. Froid Annex.: 115-23 (1961)
4938	17-9855	See TID-13139
5093	17-9173	J. Geophys. Res., 68: 55-63(1963)
5159	17-9856	See TID-14537
5272	17-7762	Health Phys. 8: 481-9(1962)
5280	17-8260	Ind. Eng. Chem., Process Design Develop. 2: 20-4(1963)
5302	17-7814	Arch. Dermatology 86: 461-4(1962)
5303	17-7815	Arch. Pathol. 74: 297-303(1962)
5403	17-8063	J. Chem. Phys. 37: 2975-85(1962)
5433	17-8841	J. Appl. Phys. 34: 364-71(1963)
5479	17-8040	J. Am. Chem. Soc., 84: 4608-9(1962)
5548	17-8698	Dep.(mc); $3.60(fs), $1.13(mf) OTS
LAMS–		
2793	17-8279	Dep.; $1.00(OTS)

Report No.	Abstract No.	Availability
2795	17-9192	Dep.; $1.75(OTS)
2807	17-8926	Dep.; $1.10(fs), $0.80(mf) OTS
2815	17-7658	Dep.; $0.50(OTS)
LNF–	**(Italian)**	
62/61	17-9193	Dep.(mc)
MATT–		
82	17-9729	Nucl. Fusion, Suppl., 487-9(1962)
148	17-7996	Dep.; $0.75(OTS)
149	17-9767	Phys. Rev. Letters 9: 415-16(1962)
MATT-Q–		
19	17-9676	Dep.; $1.00(OTS)
MCW–		
1479	17-8219	Dep.; $1.00(OTS)
MITNE–	**(Misc.)**	
21	17-8126	Dep.; $2.75(OTS)
22	17-8885	Dep.; $7.50(OTS)
ML–	**(Misc.)**	
581	17-9647	See TID-17021
897*	17-9677	$3.60(OTS)
959	17-9686	See TID-17028
MLM–		
1136	17-7659	Dep.; $2.60(fs), $0.86(mf) OTS
1137	17-7660	Dep.; $3.60(fs), $1.22(mf) OTS
1138	17-7661	Dep.; $1.60(fs), $0.80(mf) OTS
1139	17-7662	Dep.; $2.60(fs), $1.01(mf) OTS
MND-M–	**(Misc.)**	
3A-2452	17-10054	Dep.(mc); $8.60(fs), $3.14(mf) OTS
MPR-XIII–		
11-62	17-8327	See TID-17538
12-62	17-8328	See TID-17702
MRC–	**(Misc.)**	
341	17-8707	Dep.(mc); $2.60(fs), $0.83(mf) OTS
N–	**(Misc.)**	
62-10054*	17-9169	See SUI-62-1
62-10690*	17-9167	$2.60(ph), $0.98(mf) OTS
62-11728*	17-8127	$1.60(ph), $0.80(mf) OTS
62-11797*	17-8280	$1.10(ph), $0.80(mf) OTS
62-12368*	17-8128	
62-12872*	17-10196	
62-12904*	17-9168	$1.10(fs), $0.80(mf) OTS
NAA-SR–		
6514	17-8886	Dep.; $0.50(OTS)
7077	17-8590	Dep.; $1.25(OTS)
7398	17-8808	Dep.; $0.50(OTS)
7514	17-9849	Dep.; $0.75(OTS)
NAA-SR-Memo–		
5794	17-9850	Dep.(mc); $3.60(fs), $1.22(mf) OTS
NASA-SP–	**(Non-AEC)**	
11(Vol.1)	17-7674	National Aeronautics and Space Administration, Washington, D. C., Dec. 1962, 436p., $2.50(GPO)
NASA-TN–	**(Misc.)**	
D-1490*	17-8887	$1.25(OTS)
D-1563*	17-10197	$0.75(OTS)
D-1689*	17-9678	$1.00(OTS)

Report No.	Abstract No.	Availability
NASA-TR–	**(Non-AEC)**	
R-140	17-10198	$0.40(GPO)
NIRL-R–	**(British)**	
18	17-8927	Dep.; $0.63(BIS); 4s. 6d.(HMSO)
NLCO–		
852	17-8245	Dep.; $0.50(OTS)
NMI–	**(Misc.)**	
2110	17-8708	Dep.(mc); $1.10(fs), $0.80(mf) OTS
7255	17-10055	Dep.(mc); $2.60(fs), $1.07(mf) OTS
9701.3*	17-8756	
NP–	**(AEC File No. for Non-AEC Reports)**	
11896	17-8281	Dep.; $1.75(OTS)
12323	17-10199	
12325	17-8928	OTS
12326	17-8809	
12329	17-7663	Dep.(mc)
12335	17-8929	Dep.(mc)
12336	17-9504	
12340	17-8591	Dep.(mc)
12344(Vol.I)	17-10056	
12344(Vol.II)	17-10057	
12344(Vol.III)	17-10058	
12352	17-9817	
12356	17-8930	
12371	17-10200	
12372	17-9679	
12377	17-7997	
12378	17-9680	OTS
12379	17-10130	Dep.(mc); $10.50(fs), $4.16(mf) OTS
12382	17-9682	OTS
12384	17-9194	$1.60(ph), $0.80(mf) OTS
12389	17-8931	
12391	17-7998	Dep.(mc); $1.10(fs), $0.80(mf) OTS
12392	17-8386	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12393	17-8429	Dep.(mc); $2.60(fs), $1.01(mf) OTS
12395	17-8246	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12396	17-8699	Dep.(mc); $1.10(fs), $0.80(mf) OTS
12397	17-8430	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12399	17-9195	
12415	17-8932	
12422	17-8592	
12426	17-8387	
12432	17-7999	
12437	17-7956	Dep.(mc)
12441	17-9505	Dep.(mc)
12446	17-8757	
12447	17-9479	Dep.(mc)
12448	17-9196	Dep.(mc)
12449	17-9197	Dep.(mc)
12450	17-8943	Dep.(mc)
12451	17-8810	
12452	17-9198	Dep.(mc)
12456	17-9683	
12458	17-9480	
12477	17-8944	
12481	17-8811	
12485	17-8530	
12487	17-8709	
NYO–		
4816	17-8282	Dep.(mc); $5.60(fs), $2.00(mf) OTS
8103	17-7684	Dep.(mc); $1.10(fs), $0.80(mf) OTS
9192	17-8700	Dep.(mc); $1.60(fs), $0.80(mf) OTS
9524	17-8388	Dep.(mc); $4.60(fs), $1.52(mf) OTS
9533	17-7772	Dep.(mc); $5.60(fs), $1.85(mf) OTS
9760	17-8701	Dep.(mc); $4.60(fs), $1.49(mf) OTS
9771	17-8431	Dep.(mc); $13.00(fs), $5.66(mf) OTS

Report No.	Abstract No.	Availability
9844-II	17-9862	See UNC-5008-II
9918	17-7953	See CUA-NE-24
9934(Vol.I)	17-7773	Dep.(mc); $22.25(fs), $9.83(mf) OTS
10185	17-8129	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10229	17-8999	J. Math. Phys. (N. Y.) 3: 1116-29(1962)
10249	17-9152	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10392	17-8389	Dep.(mc); $4.60(fs), $1.49(mf) OTS
10412	17-8491	Dep.; $2.00(OTS)
10474	17-9851	Dep.(mc); $4.60(fs), $1.49(mf) OTS
ORA–	**(Misc.)**	
04653-4-P	17-8329	See TID-17783
ORNL–		
3188	17-9852	Dep.; $1.75(OTS)
3289	17-9646	Dep.; $2.25(OTS)
3308	17-8247	Dep.; $1.50(OTS)
3311	17-8593	Dep.; $1.00(OTS)
3371	17-8248	Dep.; $0.75(OTS)
3373	17-7941	Dep.; $0.75(OTS)
ORNL-TM–		
343	17-10219	Dep.(mc); $3.60(fs), $1.37(mf) OTS
422	17-9199	Dep.(mc); $2.60(fs), $0.98(mf) OTS
433	17-9853	Dep.(mc); $1.10(fs), $0.80(mf) OTS
440	17-8000	Dep.(mc); $2.60(fs), $0.98(mf) OTS
OTS–	**(Misc.)**	
60-51087	17-8866	341p. of "Physical and Process Metallurgy and Physicochemical Research Methods," 1958, $3.50(OTS)
61-31021	17-7888	256p. of "Works of the Institute of Higher Nervous Activity," 1958, $2.50(OTS)
PAN–	**(Polish)**	
202	17-9506	Dep.
203	17-9507	Dep.
207	17-9508	Dep.
213	17-9509	Dep.
214	17-9510	Dep.
307/XVII	17-8130	Dep.
310/XVII	17-8131	Dep.
311/XVII	17-8132	Dep.
321/IX	17-9684	Dep.
330/XIII	17-7957	Nukleonika, 7: 499-509(1962)
331/V	17-8249	Nukleonika, 7: 547-60(1962)
333/I-B	17-8531	Dep.
335/IX	17-8001	Dep.
337/IV	17-8250	Dep.
338/IV	17-8002	Dep.
342/VI	17-9200	Dep.
345/XVI	17-8251	Dep.
346/V	17-8133	Nukleonika, 7: 623-34(1962)
347(XVII)	17-8134	Nukleonika, 7: 483-6(1962)
348/VI	17-9511	Dep.
352/XIII	17-8594	Dep.
356/VII	17-9201	Dep.
357/XVII	17-8888	Dep.
358/I-A	17-9512	Dep.
359/VII	17-9202	Dep.
360/IV	17-8252	Dep.
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
869,645	17-9898	
910,826	17-8270	
910,827	17-9899	
910,843	17-9900	
910,902	17-9901	
910,941	17-8557	
910,952	17-9902	

Report No.	Abstract No.	Availability
911,062	17-8732	
911,116	17-8663	
911,132	17-9903	
911,135	17-9904	
911,194	17-8771	
911,199	17-9905	
911,200	17-9906	
911,381	17-8749	
911,446	17-8486	
911,458	17-10112	
911,466	17-9907	
911,510	17-9807	
911,511	17-9908	
911,550	17-8664	
911,593	17-9909	
911,604	17-8558	
911,612	17-9910	
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911,635	17-8305	
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911,706	17-9912	
911,710	17-9913	
911,770	17-9914	
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911,957	17-8772	
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912,282	17-8733	
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913,168	17-10183	
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913,336	17-8688	
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913,714	17-9922	
913,742	17-9923	
913,743	17-8667	
913,818	17-9924	
913,858	17-9925	
913,867	17-9926	
913,887	17-9927	
913,897	17-9928	
913,920	17-9929	
913,928	17-9930	
913,956	17-9147	
913,962	17-8668	
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914,154	17-8776	
914,163	17-9931	
914,178	17-9932	
914,181	17-8669	
914,219	17-8309	
914,304	17-8561	

Report No.	Abstract No.	Availability
914,351	17-9933	
914,380	17-9934	
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914,772	17-8311	
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915,062	17-8735	
915,166	17-8564	
915,190	17-9943	
915,215	17-9944	
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915,362	17-9949	
915,370	17-9950	
915,383	17-9951	
915,438	17-8778	
915,443	17-9815	
PATENTS	**(Czechoslovakia)**	
96,110	17-8714	See CEA-tr-X-475
PATENTS	**(French)**	
75,699	17-8736	See French Patent 1,225,153(Add.)
76,850	17-9956	See French Patent 1,238,281(Add.)
77,374	17-9954	See French Patent 1,218,482(Add.)
1,210,082	17-9952	
1,218,482	17-9953	
1,218,482(Add.)	17-9954	
1,225,153(Add.)	17-8736	
1,231,675	17-9955	
1,235,630	17-8779	
1,238,281(Add.)	17-9956	
1,239,599	17-10117	
1,245,913	17-9957	
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1,261,526	17-9959	
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1,271,772	17-8782	
1,271,794	17-8737	
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1,273,272	17-9969	
1,273,431	17-9970	
1,273,932	17-9971	
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1,286,933	17-10001	
1,287,558	17-10002	
1,288,485	17-10003	
1,288,894	17-10004	
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,050,367	17-8691	
3,050,453	17-8216	
3,050,454	17-10005	
3,050,574	17-9148	
3,050,622	17-8565	
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3,050,627	17-8566	
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3,067,365	17-9149	
3,068,159	17-10010	
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3,069,227	17-8107	
3,069,228	17-8229	
3,069,256	17-8790	
3,069,283	17-8791	
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3,069,339	17-10015	
3,069,341	17-10118	

Report No.	Abstract No.	Availability
3,069,342	17-10016	
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3,069,344	17-9809	
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3,069,654	17-8572	
3,070,420	17-8108	
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3,075,583	17-8582	
3,075,637	17-8797	
3,075,694	17-8316	
3,075,825	17-8272	
3,075,925	17-9816	
3,076,091	17-8583	
PG-Report–	**(British)**	
348	17-7958	Dep.
386	17-8684	Dep.; $0.21(BIS); 1s. 6d.(HMSO)
PST-Cat.–	**(Misc.)**	
386	17-8866	See OTS-60-51087
536	17-7888	See OTS-61-31021
R–	**(Misc.)**	
62SD14*	17-9685	
2080*	17-8385	See A/AC.82/G/L.795
2146	17-8802	See EURAEC-381
RAI–		
311	17-8135	Dep.; $2.25(OTS)
RD–	**(Misc.)**	
0008	17-8324	See TID-11603
0009	17-10060	See TID-11602
RED-EPM–		
103	17-9514	See TID-17675
RISÖ–	**(Danish)**	
43	17-10131	Dep.(mc)
46	17-8945	Dep.(mc)
47	17-9854	Dep.(mc)
RT-AI–	**(Italian)**	
(62)3	17-7667	Comit. Naz. Energia Nucl. Notiziario 8: No. 6, Sp.(1962)
RT-BIO–	**(Italian)**	
(62)5	17-7685	Dep.(mc)
(62)35	17-7880	Z. Vererbungslehre 93: 118-26(1962)
RT-CHI–	**(Italian)**	
(62)13	17-7959	Dep.(mc)
(62)19	17-8253	Dep.(mc)
RT-CNI–	**(Italian)**	
(62)4	17-8003	Dep.(mc)
RT-EC–	**(Italian)**	
(62)3	17-7666	Comit. Naz. Energia Nucl., Notiziario 8: No. 2, 3-12(1962)
RT-EL–	**(Italian)**	
(62)6	17-8532	Dep.(mc)
(62)11	17-8595	Dep.(mc)
(62)13	17-8533	Dep.(mc)
RT-GEO–	**(Italian)**	

Report No.	Abstract No.	Availability
(62)6	17-8395	Comit. Naz. Energia Nucl., Notiziario 8: No. 6, 7p.(1962)
(62)7	17-8222	Comit. Naz. Energia Nucl., Notiziario 8: No. 6, 80-5(1962)
RT-ING–	**(Italian)**	
(62)6	17-9877	Comit. Naz. Energia Nucl., Notiziario 8: No. 5, 16-29(1962)
RT-MET–	**(Italian)**	
(62)4	17-8812	Dep.(mc)
SB–	**(Non-AEC)**	
500	17-7673	$0.10(OTS)
SCDC–		
2685	17-8006	See TID-16040
2749	17-8173	See TID-16445
2935	17-8382	See TID-17434
SCL-T–		
459	17-8955	Dep.(mc); $1.60(fs), $0.80(mf) JCL
SCR–		
526	17-8006	See TID-16040
558	17-9485	J. Math. Mech. 11: 173-82(1962)
565	17-8405	See TID-15454
SCTM–		
14-62(14)	17-7960	Dep.(mc); $2.60(fs), $1.01(mf) OTS
74-62(13)	17-8534	Dep.(mc); $8.60(fs), $3.08(mf) OTS
224-62(11)	17-8813	Dep.(mc); $3.60(fs), $1.37(mf) OTS
SM–	**(Misc.)**	
36/21*	17-10131	See RISO-43
SRO–		
76	17-10059	Dep.(mc); $1.10(fs), $0.80(mf) OTS
STI-DOC–	**(International Atomic Energy Agency)**	
10/11	17-8512	A Comprehensive Report from a Panel held in Vienna, November 6-9, 1961, 1962. $1.00(IAEA)
SUI–	**(Misc.)**	
62-1*	17-9169	
TDR–	**(Non-AEC)**	
169(3153)TR-1	17-9675	See BSD-TDR-62-237
TID–		
7640	17-8492	Dep.; $2.00(OTS)
11602	17-10060	Dep.(mc); $5.60(fs), $1.82(mf) OTS
11603	17-8324	Dep.(mc); $12.00(fs), $5.27(mf) OTS
12910	17-8554	p.75-87 of "Temperature—Its Measurement and Control in Science and Industry. Vol. 3, Pt. 1. Basic Concepts, Standards, and Methods. 4th Symposium, March 27-31, 1961, Columbus, Ohio." Reinhold Publishing Corp., 1962
13139	17-9855	Dep.(mc); $1.60(fs), $0.80(mf) OTS
13248	17-8079	Physik. Verhandl., No. 1-2: 60-97(1962)
13525	17-8059	J. Chem. Phys. 37: 2693-8(1962)
13875	17-8541	Bull. Inst. Intern. Froid, Annexe 5: 125-33(1961)
13890	17-9730	Nucl. Fusion, Suppl., 497-509(1962)
13892	17-9748	Nucl. Fusion, Suppl., 663-74(1962)
14537	17-9856	Dep.(mc); $2.60(fs), $0.83(mf) OTS
14622	17-8447	Health Phys. 8: 499-502(1962)
14624	17-7791	Dep.(mc); $4.60(fs), $1.43(mf) OTS
14716	17-8004	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15268	17-8946	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15454	17-8405	J. Geophy. Res., 67: 4653-72(1962)
15541	17-8596	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15543	17-8947	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15547	17-9481	Dep.(mc); $2.60(fs), $0.92(mf) OTS
15552	17-8597	Dep.(mc); $2.60(fs), $0.86(mf) OTS
15554	17-8005	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15556	17-8325	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15753	17-8687	28p. of "A Generalized Cascade for Multicomponent Isotope Separation." American Institute of Chemical Engineers, 1962, $0.50
15760	17-8024	Appl. Phys. Letters 1: 2-3(1962)
15870	17-7774	Dep.(mc); $3.60(fs), $1.13(mf) OTS
15995	17-9334	p.134-7 of "1962 International Conference on High-Energy Physics at CERN." Geneva, European Organization for Nuclear Research, 1962
16040	17-8006	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16277	17-9547	Nucl. Phys. 39: 147-59(1962)
16315(Del.)	17-8710	Dep.; $0.50(OTS)
16445	17-8173	J. Chem. Phys. 37: 2777-82(1962)
16649	17-8340	11p. of "Interaction of Heat Transfer by Conduction, Convection, and Radiation in a Radiating Fluid." The American Society of Mechanical Engineers, 1962
16821	17-8702	Dep.(mc); $12.00(fs), $5.30(mf) OTS
16845	17-7840	Genetics 47: 1505-18(1962)
16902	17-8026	Appl. Phys. Letters 2: 22(1963)
16916	17-9037	Phys. Rev. Letters 9: 383-5(1962)
16951	17-9170	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17021	17-9647	Dep.(mc); $4.60(fs), $1.61(mf) OTS
17028	17-9686	Dep.(mc); $2.60(fs), $0.95(mf) OTS
17043	17-8974	J. Appl. Phys. 34: 319-22(1963)
17081	17-10095	Nucleonics 20: 52-5(1962)
17143	17-8195	Vortex 23: No. 8, 14p.(1962)
17208	17-8283	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17245	17-9265	Phys. Rev. Letters 9: 518-20(1962)
17356	17-8136	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17391	17-9857	Dep.(mc); $2.60(fs), $1.10(mf) OTS
17395	17-9858	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17398	17-8948	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17415	17-9648	Dep.(mc); $2.60(fs), $0.89(mf) OTS
17421	17-7749	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17424	17-7686	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17425	17-7792	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17426	17-7793	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17427	17-7794	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17434	17-8382	Dep.(mc); $7.60(fs), $2.51(mf) OTS
17446	17-7795	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17451	17-7796	Dep.(mc); $2.60(fs), $0.86(mf) OTS
17461	17-8686	Proceedings of the AEC-Contractors Meeting, held in Chicago, October 1962
17473	17-9859	Dep.(mc); $8.60(fs), $2.99(mf) OTS
17475	17-9687	Dep.(mc); $7.60(fs), $2.39(mf) OTS
17489	17-9513	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17502	17-7797	Dep.(mc); $2.60(fs), $0.98(mf) OTS
17519	17-8220	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17520	17-7961	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17525	17-8326	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17527	17-9627	IAEA Proceedings of the Symposium on Neutron Detection, Dosimetry and Standardization, Harwell, United Kingdom, December 10-14, 1962
17530	17-8814	Dep.(mc); $4.60(fs), $1.52(mf) OTS
17538	17-8327	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17544	17-7798	Dep.(mc); $7.60(fs), $2.39(mf) OTS
17546	17-8815	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17547	17-7750	Dep.(mc); $3.60(fs), $1.22(mf) OTS

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17552	17-7751	Dep.(mc); $2.60(fs), $0.98(mf) OTS
17556	17-8711	Dep.(mc); $8.60(fs), $2.90(mf) OTS
17578	17-9649	Dep.(mc); $10.50(fs), $4.28(mf) OTS
17579	17-7799	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17580	17-7800	Dep.(mc); $4.60(fs), $1.64(mf) OTS
17583	17-8137	Dep.(mc); $3.60(fs), $1.34(mf) OTS
17585	17-8744	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17592	17-8535	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17593	17-8712	Dep.(mc); $10.10(fs), $4.07(mf) OTS
17610	17-8536	Dep.(mc); $3.60(fs), $1.34(mf) OTS
17641	17-7801	Dep.(mc); $3.60(fs), $1.40(mf) OTS
17650	17-7802	Dep.(mc); $3.60(fs), $1.28(mf) OTS
17654	17-8703	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17655	17-9860	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17656	17-8383	Dep.(mc); $4.60(fs), $1.58(mf) OTS
17657	17-8254	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17658	17-9861	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17667	17-8007	Dep.(mc); $2.60(fs), $1.01(mf) OTS
17671	17-8391	Dep.(mc); $9.10(fs), $3.32(mf) OTS
17673	17-8008	Dep.(mc); $5.60(fs), $1.85(mf) OTS
17674	17-8138	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17675	17-9514	Dep.(mc); $4.60(fs), $1.49(mf) OTS
17683	17-9515	Dep.(mc); $8.60(fs), $2.93(mf) OTS
17687	17-8009	Dep.(mc); $10.10(fs), $4.01(mf) OTS
17695	17-7803	Dep.(mc); $7.60(fs), $2.60(mf) OTS
17702	17-8328	Dep.(mc); $2.60(fs), $0.86(mf) OTS
17765	17-8139	Dep.(mc); $3.60(fs), $1.22(mf) OTS
17767	17-8010	Dep.(mc); $3.60(fs), $1.37(mf) OTS
17776	17-8889	Dep.(mc); $2.60(fs), $1.01(mf) OTS
17777	17-8598	Dep.(mc); $1.10(fs), $0.80(mf) OTS
17783	17-8329	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17787	17-8949	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TRG-Report–	**(British)**	
198	17-10061	Dep.; $0.70(BIS); 5s.(HMSO)
UAC–		
5705	17-7791	See TID-14624
5777	17-8004	See TID-14716
5993	17-8946	See TID-15268
6031	17-8597	See TID-15552
6084	17-8005	See TID-15554
6097	17-8596	See TID-15541
6157	17-8947	See TID-15543
6161	17-8325	See TID-15556
6857	17-9513	See TID-17489
6924	17-8703	See TID-17654
6936	17-8380	See ANL-FGF-386
6938	17-7803	See TID-17695
6948	17-8799	See ANL-FGF-397
6978	17-8007	See TID-17667
7007	17-8598	See TID-17777
7008	17-8889	See TID-17776
UCLA–		
509	17-7687	Dep.(mc); $5.60(fs), $1.88(mf) OTS
UCRL–		
6575	17-9650	Dep.(mc); $4.60(fs), $1.49(mf) OTS
6578(Rev.II)	17-8290	New Scientist 15: 36-40(1962)
6731	17-8950	Dep.(mc); $1.10(fs), $0.80(mf) OTS
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6878	17-8600	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6893	17-8011	Dep.(mc); $8.10(fs), $2.72(mf) OTS
6902-T	17-9171	Dep.(mc); $2.60(fs), $1.07(mf) OTS
6945-T	17-8012	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6986	17-9055	Rev. Sci. Instr. 33: 1477-8(1962)
7008	17-8299	Rev. Sci. Instr. 33: 1475-6(1962)
7011	17-8298	Rev. Sci. Instr. 33: 1474-5(1962)
7033	17-9689	Dep.; $0.75(OTS)
7141	17-9045	Phys. Rev. Letters 10: 7-9(1963)
9843(Rev.)	17-8537	Dep.(mc); $1.10(fs), $0.80(mf) OTS
9995	17-9516	J. Inorg. Nucl. Chem., 24: 1175-9(1962)
10075	17-9651	Dep.(mc); $1.10(fs), $0.80(mf) OTS
10096	17-8970	Discussions Farsday Soc. No. 33: 149-61 (1962)
10105	17-8013	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10134	17-8053	J. Chem. Phys. 37: 2440-4(1962)
10141	17-8014	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10174	17-9257	Phys. Rev. Letters 9: 466-8(1962)
10190	17-9548	Nucl. Phys. 39: 160-8(1962)
10208	17-8983	J. Fluid Mech. 14: 568-76(1962)
10417	17-9517	Dep.; $2.00(OTS)
10421	17-8538	Dep.; $1.50(OTS)
10424	17-7688	A.I.B.S. (Am. Inst. Biol. Sci.) Bull. 12: 29-44(1962)
10426	17-8816	Dep.; $1.75(OTS)
10466	17-8953	Dep.; $2.50(OTS)
10468	17-8817	Dep.; $2.00(OTS)
10470	17-9203	Dep.; $1.50(OTS)
10478	17-9267	Phys. Rev. Letters 10: 27-9(1963)
10486	17-9252	Phys. Rev. Letters 9: 400-2(1962)
10497	17-8015	Dep.; $0.75(OTS)
10510	17-8954	Dep.; $2.00(OTS)
10530	17-9204	Dep.; $1.75(OTS)
10564	17-9205	Dep.; $2.50(OTS)
10577	17-8140	Dep.(mc); $1.60(fs), $0.80(mf) OTS
13043(Rev.)	17-8332	ARS (Am. Rocket Soc.) J. 32: 1902-9 (1962)
13052	17-8818	Dep.; $2.75(OTS)
13057	17-8819	Dep.(mc); $11.50(fs), $4.73(mf) OTS
UCRL-Trans.–		
832(L)	17-8956	Dep.(mc); $2.60(fs), $0.86(mf) JCL
867(L)	17-9692	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
882(L)	17-8823	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
893(L)	17-7966	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
UNC–	**(Misc.)**	
5008-II	17-9862	Dep.; $2.50(OTS)
USNRDL-TR–	**(Non-AEC)**	
593	17-9518	
595	17-7804	
597	17-7805	
VDIT–	**(Swedish)**	
67	17-8221	Dep.(mc)
WAPD–	**(Misc.)**	
272	17-10063	Dep.; $1.50(OTS)
WAPD-PWR–		
TE-65	17-10064	Dep.(mc); $10.50(fs), $4.25(mf) OTS
TE-71	17-10065	Dep.(mc); $6.60(fs), $2.09(mf) OTS
TE-74	17-10066	Dep.(mc); $6.60(fs), $2.06(mf) OTS
TE-78	17-10067	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TE-92	17-10068	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TE-95	17-10069	Dep.(mc); $4.60(fs), $1.64(mf) OTS
WAPD-R–		
(WB)-1	17-8704	Dep.(mc); $1.60(fs), $0.80(mf) OTS
WAPD-T–		
1252	17-10070	Dep.(mc); $1.60(fs), $0.80(mf) OTS
1278	17-10071	Dep.(mc); $5.60(fs), $1.82(mf) OTS
1481	17-9482	Dep.(mc); $1.60(fs), $0.80(mf) OTS
1528	17-10072	Dep.(mc); $1.60(fs), $0.80(mf) OTS

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1534	17-9863	Dep.(mc); $2.60(fs), $1.07(mf) OTS
1543	17-7962	Dep.(mc); $1.60(fs), $0.80(mf) OTS
WAPD-TM-	**(Misc.)**	
330	17-10073	Dep.; $0.50(OTS)
337	17-10074	Dep.; $1.00(OTS)
WASH-		
1040	17-9519	Dep.; $1.25(OTS)
WCAP-	**(Misc.)**	
1556*	17-10132	
1997(Rev.)*	17-8330	
2117	17-8601	Dep.(mc); $1.60(fs), $0.80(mf) OTS
4128	17-10075	Dep.(mc); $1.10(fs), $0.80(mf) OTS
4129	17-10076	Dep.(mc); $1.10(fs), $0.80(mf) OTS
WIS-NSF-	**(Non-AEC)**	
19	17-9818	
XDCL-		
60-8-40	17-8820	Dep.(mc); $3.60(fs), $1.31(mf) OTS
Y-		
1408	17-8255	Dep.; $0.75(OTS)